Series 1958, No. 8 Issued March 1961

SOIL SURVEY

Haskell County Texas

OUR SOIL ★ OUR STRENGTH

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
TEXAS AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of Haskell County, Tex., will serve various groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, ponds, buildings, and other structures; aid ranchers in managing their range; and will add to the knowledge of soil scientists.

In making this survey soil scientists walked over the fields and ranches. They dug holes at many places and examined the surface soils and subsoils; measured slopes with a hand level; noticed differences in the growth of crops, weeds, and brush; and, in fact, recorded all the things about the soils that they believed might affect their suitability for farming, grazing, and related uses.

The scientists plotted the boundaries of the soils on aerial photographs. Then, from these photographs, cartographers prepared the detailed soil map in the back of this report. Fields, roads, streams, and many other landmarks can be seen on the map.

Fieldwork for this survey was completed in 1958. Unless otherwise indicated, statements in this report refer to conditions at the time the survey was in progress.

Locating the soils

Use the Index to Map Sheets at the back of this report to locate areas on the large soil map. The index is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located. When the correct sheet of the large map has been located, it will be seen that boundaries of the soils are outlined and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they appear on the map. The symbol will be inside the area if there is enough room; otherwise, it will be outside the area and a pointer will show where the symbol belongs.

Suppose, for example, an area located on the map has the symbol AcA. The legend for the detailed map shows that this symbol identifies Abilene clay loam, 0 to 1 percent slopes. This soil and all others mapped in the county are described in the section "Descriptions of Soils."

Finding information

Some readers will be more interested in one part of the report than in another, for the report has special sections for different groups of readers, as well as some sections that may be of value to all.

Farmers and ranchers and those who work with farmers and ranchers can learn about the soils in the section "Descriptions of Soils," and then turn to the section "Use and Management of Soils." In this way they first identify the soils on their farm or ranch and then learn how these soils can be managed and what yields can be expected. The soils are grouped by capability units; that is, groups of soils that need similar management and respond in about the same way. For example, Abilene clay loam, 0 to 1 percent slopes, is shown to be in capability unit IIc-1 and in the Deep Hardlands, Rolling Plains range site. The management this soil needs will be stated under the heading, capability unit IIc-1, in the section "Use and Management of Soils." Additional facts about its management will be found in the section "Range Management."

The "Guide to Mapping Units" at the back of the report will simplify the use of the map and the report. This guide gives the map symbol for each soil, the name of the soil, the page on which the soil is described, the capability unit and the page where each unit is described, and the range site in which the soil has been placed.

Engineers will want to refer to the section "Engineering Uses of Soils." Tables in that section show characteristics of the soils that affect engineering.

Soil scientists and others interested in learning about how the soils were formed and how they are classified, will find this information in the section "Formation and Classification of Soils."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest. The section "Additional Facts About the County" will be of special interest to those not familiar with the county.

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SOIL SURVEY OF HASKELL COUNTY, TEXAS

By Irvin C. Mowery, M. T. Turner, Dale Gooch, Jack C. Williams, R. B. Hailey, and Tom Robinson, Soil Conservation Service

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

HASKELL COUNTY is in west-central Texas in the eastern part of the Rolling Plains. The total area of the county is 889 square miles, or 568,960 acres. The elevation above sea level ranges from 1,400 to about 1,680 feet. Haskell, the county seat, is 55 miles north of Abilene. The location of the county in Texas and distances by air from Haskell to other cities in the State are shown in figure 1.

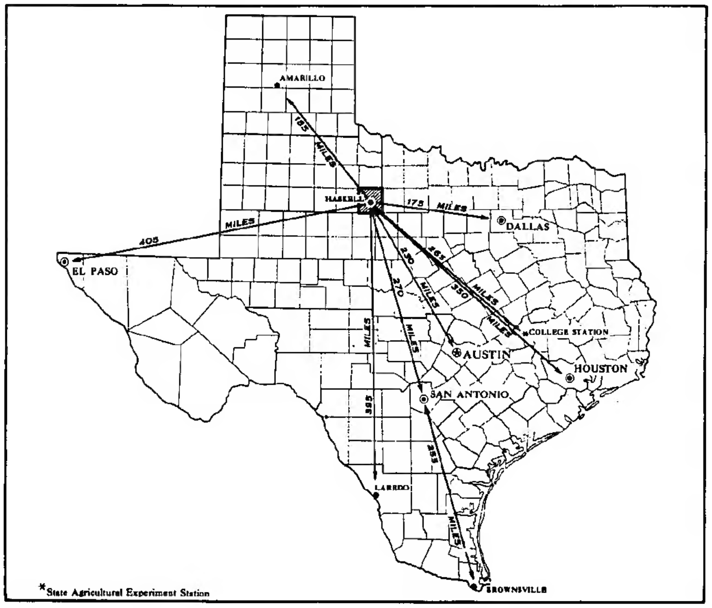

Figure 1.—Location of Haskell County in Texas.

Most of Haskell County has fairly smooth to gently sloping topography. The sandy areas, however, are undulating to hummocky, and there are a few deep canyons in the southeastern corner of the county. The walls of these canyons are limestone. The soils of the county have formed in materials from Quaternary outwash, from Permian red beds, from limestone, and from alluvium. Crops grow best on soils developed in the outwash material. The choicest rangeland is made up of soils developed in materials from limestone.

Agriculture has always been important in the county, and cotton has always been the main crop. The principal industry is petroleum production. There are producing oil wells in nearly all parts of the county.

Summers in Haskell County are hot and dry; winters are moderately cold with occasional spells of severe cold weather. The average annual rainfall is about 24 inches.

Because of the need to conserve rainfall and to protect the soils, the farmers in the southern half of the county helped organize the California Creek Soil Conservation District in 1941. Farmers in the rest of the county became members of the Wichita-Brazos Soil Conservation District when it was organized in 1943. Through these districts, the farmers receive technical help from the Soil Conservation Service in planning for the use and conservation of the soils on their farms. This soil survey report is part of the technical assistance provided.

General Soil Areas

In mapping a county or other large tract, it is fairly easy to see differences as one travels from place to place. There are many obvious differences in the shape, gradient, and length of slopes; in the course, depth, and speed of streams; in the width of the bordering valleys; in the kinds of wild plants; and in the kinds of agriculture. With these more obvious differences, there are others, less easily noticed, in the pattern of the soils. The soils differ along with other parts of the environment.

By drawing lines around the different patterns of soils on a small map, one may obtain a map of the general soil areas, or, as they are sometimes called, soil associations. Such a map is useful to those who want a general idea of the soils, who want to compare different parts of the county, or who want to locate large areas suitable for some particular kind of agriculture or other broad land use.

The eight general soil areas, or kinds of soil patterns, in Haskell County are shown on a colored map at the back of this report. The areas are named for the major soil series in them, but soils of other series may be present in any of the areas. Also, the major soil series of one area may occur in other areas. A brief description of each soil association follows. More detailed information about individual soils in the associations can be obtained from the detailed soil map and by reading the section "Descriptions of Soils."

Soils in Alluvium

The soils of bottom lands occupy about 8 percent of the county. They occur in all parts of the county except the northwestern. The soils developed in alluvium are in soil association 1.

1. Miller-Norwood association—fine-textured soils on flood plains

The Miller and Norwood soils are the principal soils in this association. They occur on flood plains

and have developed in alluvium. Small acreages of Yahola fine sandy loam, of Alluvial land, and of Spur soils are included in the association. The Yahola soil and Alluvial land are along the Double Mountain Fork of the Brazos River. The Spur soils occur along Lake Creek.

Many areas of this association are small and narrow and are flooded too frequently for crops to grow successfully. The soils are low in organic matter, and their surface tends to seal over after rains. Alluvial land and Yahola fine sandy loam are likely to be eroded by wind if they are not protected.

About 17 percent of the total acreage in this association is cultivated. Cotton, sorghum for grain and fodder, summer and winter peas, wheat, oats, and guar are the crops generally grown. A large part of the association is within large ranches. No one farm is made up entirely of soils of bottom lands.

Soils in Red-Bed Materials

Soils developed in materials from red beds occupy about 34 percent of the acreage in the county. They consist of deep clay loams and of shallow clays and clay loams. Soils formed in materials from red beds are in associations 2 and 3. They occur throughout the southern and eastern three-fourths of the county, except in the extreme southeastern part.

2. *Tillman-Foard-Hollister association—deep clay loams*

This association consists mostly of deep clay loams formed in materials from red beds. The principal soils are the Tillman, Foard, and Hollister, but a minor part of the association is made up of Stamford, Owens, shallow Tillman soils, and soils of the Tillman-Foard complex.

The soils in this association have a thin, crusty surface layer and a subsoil of tight clay that resembles a pan. Water infiltrates very slowly. The soils have a high water-holding capacity, but little of the water is available to plants. Consequently, the soils are limited in their use for crops.

The soils are mostly nearly level to gently sloping. Tillman clay loams, shallow, are somewhat sloping, and most areas of Stamford soils have moderate slopes. Soils that have slopes of more than 1 percent are susceptible to water erosion.

In this association more than one-half of the acreage is cultivated, but yields are low. The soils are droughty; therefore, they are better suited to small grains, winter peas, and similar crops that grow well in cool seasons than they are to other crops. Cotton and sorghum are grown in some areas. In most years cotton yields only about one-fourth bale and grain sorghum yields only about 500 pounds per acre. If rainfall is timely or if more than the usual amount of it falls during the growing season, however, cotton yields as much as 1 bale and grain sorghum as much as 2,000 pounds per acre. Raising livestock and growing crops, mainly small grains, is probably the best use for the soils.

Farms within this association average about 350 acres in size, although there are several ranches and other large holdings. Few of the farmers live on their farms.

3. *Vernon-Tillman, shallow, association—shallow clays and clay loams*

This association is made up mainly of shallow, droughty Vernon and Tillman soils and of areas of Rough broken lands. A smaller acreage is occupied by the Cottonwood soil. The topography is rough, and, in most places, the soils are eroded.

The soils in this association are better suited to small grains and winter peas than to other crops. Only a small acreage is suited to crops, however, and only about one-half of the acreage can be improved for pasture. Crops are grown on about 3,500 acres of Tillman and uneroded Vernon soils. Conserving water and controlling erosion are the principal management problems.

If the smoother areas of Vernon and shallow Tillman soils are well managed, they can be grazed and will produce fair yields of forage. The pastures can be improved somewhat by controlling grazing; using practices to control brush; seeding; and pitting or contour furrowing the areas. Areas of Rough broken lands that cannot be used for grazing are suitable for wildlife, for watershed development, and for recreation.

More than 80 percent of this association is in large ranches.

Soils in Quaternary Outwash

Soils developed in materials from outwash of Quaternary age occupy about one-half of the county. They consist of deep clay loams and clays, of deep loams and fine sandy loams, and of deep loamy sands. These soils are in associations 4, 5, and 6. They occupy the entire northwestern part of the county. Isolated areas also occur in most other parts of the county.

4. *Abilene-Roscoe association—deep clay loams and clays*

This association is made up mostly of deep clay loams and clays formed in materials from outwash of Quaternary age. The principal soils are the Abilene and Roscoe, but Drake, Mansker, Miles, Portales, and Wichita soils occupy a smaller acreage. The association occurs in all parts of the county, except the northwestern and southeastern.

Most areas of the soils are large and smooth. In about 21 percent of the acreage, however, the soils have slopes of more than 1 percent, and, in a small part of the acreage, the slopes are more than 3 percent. The gently sloping areas need protection from water erosion.

These soils are slowly permeable and have high water-holding capacity. Nevertheless, during long, dry periods, yields of crops are reduced because much of the water held by the soils is not available to plants. Even on the nearly level areas, practices are needed to conserve water and to maintain good tilth. Water causes erosion on slopes of more than

1 percent unless good management is used. About 20 percent of such areas are already eroded. Wind erosion is not a serious problem if simple management practices are used to protect the soils.

These soils are well suited to all of the crops that can be grown in this climate. About 82 percent of the acreage is used for crops, principally cotton, wheat, oats, and sorghum. In addition, barley, guar, summer and winter peas, vetch, sudangrass, and sorghum almum are grown on a small acreage. Rye and Hubam and Madrid sweetclovers can also be grown. A small acreage of cultivated soils is under irrigation. Most of the association that is not cultivated is in small pastures.

Farms in the association average about 200 acres in size. Most of the farms that are owned by the operator are in this association. The owners generally live on the farm, although a number live in town.

5. *Abilene-Miles association—deep loams and fine sandy loams*

This association is made up of deep loams and fine sandy loams formed in materials from outwash of Quaternary age. The Abilene and Miles are the principal soils. They occupy more than three-fourths of the total acreage. The remainder consists of Enterprise, Portales, and Tipton soils. In places the Abilene and Miles soils are mapped together because the areas are too intermixed to map separately. Most of this association is in the northwestern part of the county. It occupies a strip between association 4, which is southeast of it, and association 6, to the northwest.

The topography of the association varies. The Abilene soils are smooth and nearly level, and the Miles soils are gently sloping to undulating. Nearly half of the acreage in the association is undulating. In a few small areas, the soils have slopes of as much as 8 percent.

The soils in this association have high water-holding capacity and hold much of the water available for plants to use. In the undulating areas and in some of the gently sloping to moderately sloping areas, water erosion is likely to occur. The control of wind erosion, however, is the main problem.

About 84 percent of the acreage in this association is cultivated. The soils are well suited to a number of crops that can be grown in this climate, and yields are moderately high. Cotton, maize, oats, wheat, and sorghum are the principal crops, but guar, summer and winter peas, vetch, and sudangrass are grown on small acreages. The crops seldom fail, even in years of drought. A small part of the cropland is irrigated. Most of the land that is not cultivated is in small pastures.

The farms in this association average about 200 acres in size. Many of them are operated by the owner. Some of the operators live on the farm, and others live in a nearby town.

6. *Miles-Springer association—deep, loamy sands*

The soils in this association are deep, loamy sands formed in materials from outwash of Quaternary age. Miles and Springer soils make up most of the association, but a small part consists of Altus soils. The association occurs in the northwestern corner of the county.

The soils of this association range from undulating to hummocky. The rough, choppy topography was caused by eroding winds that shifted the soil materials about. Some of the hummocks were formed thousands of years ago; others are still forming. The hummocks range from about 3 to 15 feet in height; slopes between the highest and lowest points range from 3 to 8 percent. In managing the soils, however, the slopes are not so important as the general shape of the land surface.

The Miles soils are more productive than the Springer. The soils are moderate in water-holding capacity and hold much of the water available for plants to use. Water erosion is not serious, but wind erosion causes severe damage.

About 80 percent of this association is cultivated. Cotton and sorghum are the principal crops, but wheat, oats, guar, and summer and winter peas are grown on a small acreage. The soils are likely to be damaged by wind erosion, and using them for row crops is hazardous. Nevertheless, yields of cotton and grain sorghum grown on these soils are among the highest in the county. Management is needed that will permit some row crops to be grown and that will also protect the soils from wind erosion.

Only a small part of the cropland is irrigated and that by the sprinkler method. The small areas not cultivated are mostly in pasture. These are probably the only soils under dryland farming that will respond if fertilizer is applied each year.

Combining the growing of cash crops with the raising of livestock is probably the best use for these soils. With this system, a smaller proportion of the acreage is planted to cotton and a larger proportion is planted to sorghum, wheat, and oats.

The farms in this association average about 225 acres in size. Few of the operators live on the farms.

Soils in Limestone

Soils that developed over limestone occupy about 8 percent of the county. They consist of moderately deep clays and of shallow, stony soils. These soils make up associations 7 and 8. They are in the southeastern corner of the county.

7. *Valera-Byrds association—moderately deep clays*

This association consists of Valera and Byrds soils. The soils are mainly moderately deep clays developed over beds of broken limestone, but in some areas they are shallow. They occur on high, broad, smooth divides flanked by areas of Tarrant stony clays.

The soils in this association are crumbly and have a high water-holding capacity. Their slopes are seldom more than 2 percent.

Large ranches occupy most of this association. About 16 percent of the acreage is cultivated. Wheat,

oats, and sorghum are the principal crops, but a small acreage is used for cotton. Except for the cotton, the crops are used mainly for grazing or as feed for livestock. Grasses grown on the soils are nutritious. Guar and summer and winter peas can be grown successfully and will make moderate yields on the deeper soils.

The soils are probably best used for ranching along with the shallow, stony soils of association 8.

8. Tarrant association—shallow, stony soils

This association is made up mainly of shallow, stony Tarrant soils developed over limestone, but a small acreage consists of Valera stony clay.

Many large fragments of limestone are scattered over the soils, and there are many deep canyons. Slopes range from 0 to more than 20 percent, but in about one-half of the total acreage the soils have slopes of more than 8 percent. Some areas along streams are so steep they resemble cliffs. Stones are the most numerous in areas where the slopes are the strongest.

In general, grasses that grow on these soils are of good quality, and grazing is probably the best use of the soils. It is difficult to use machinery to improve the soils. Consequently, other than controlling grazing, little can be done to improve grass production.

All of this association is occupied by large ranches. Selected areas can be used for wildlife or for recreation.

Descriptions of Soils

The soil scientists who prepared this soil survey went over the area and examined the soils at intervals of about a quarter of a mile by digging with a spade, auger, or power soil sampler. They examined the different layers, or horizons, in each boring, and they compared the different borings. By such comparisons, they determined the different kinds of soils in the area. They then described the various soils and drew boundaries on aerial photographs to separate them.

The soil series, the soil types, and the individual soils are described in the following pages. The approximate acreage in various uses, the total acreage, and the proportionate acreage of the soils are shown in table 1. The location of the soils is shown on the detailed map at the back of this report.

An important part of each soil description is the soil profile, which is a record of what the soil scientists saw and learned when they dug into the ground. All of the soils of one series have essentially the same kind of profile. The differences, if any, are explained in the description of the soil or are indicated in the name of the soil. Within the soil series, the soils of any one soil type are even more nearly alike. To illustrate, a detailed profile is described for the Abilene clay loams, and the reader is to conclude that all of the Abilene clay loams in the county have essentially this kind of profile.

Following the name of each soil, there is a set of symbols in parentheses. These identify the soil on the detailed soil map. The capability unit and the range site are given for each soil. Information about capability units and range sites is given in the section "Use and Management of Soils."

Some of the characteristics observed by the soil scientists include color, texture, structure, and consistence. These are discussed in the paragraphs that follow. Other terms, not discussed here but used in describing the soils, are defined in the Glossary in the back part of this report.

Color is normally related to the amount of organic matter in the soil. The darker the surface soil, as a rule, the more organic matter it contains. Streaks or spots of gray, yellow, and brown in the lower layers generally indicate poor drainage and poor aeration.

In this soil survey the colors of the soils are described both in words and in symbols--dark grayish brown (10YR 4/2), for example. The symbol in parentheses, called a Munsell color notation, indicates color more precisely than is possible with words. For most profiles described in this soil survey, the color names and equivalent Munsell color notations are given for both the dry and moist soil. If only one color name, such as dark brown, is used in the description, the color of the soil when moist is little different from the color when dry. If two color names are given, the first is the color of the soil when dry.

Texture, or the content of sand, silt, and clay in the soil, is determined by the way the soil feels when it is rubbed between the fingers. It is later checked by laboratory analysis. Texture determines how well the soil holds moisture, plant nutrients, and fertilizer and whether it is easy or difficult to cultivate.

Structure is the way the individual soil particles are arranged in larger grains and the amount of pore (open) space between grains. Structure indicates the ease or difficulty with which the soil is penetrated by plant roots, water, and air.

Consistence, or the tendency of the soil to crumble or to stick together, indicates whether the soil is easy or difficult to keep open and porous under cultivation.

Other characteristics observed in the course of the field study and considered in classifying the soil are the presence of gravel or stones that may interfere with cultivation; the steepness and pattern of slopes; the degree of erosion; the nature of the underlying parent material from which the soil has formed; the surface and internal drainage; and the reaction (acidity or alkalinity) of the soil as measured by chemical tests.

Abilene Series

The Abilene series consists of deep, dark, noncalcareous soils that have a clayey subsoil. Some areas are large and nearly level, and others are smaller and gently sloping. The soils developed under short grasses in materials from Quaternary outwash. In many places the gently sloping areas that have been cultivated are slightly eroded and have rills and other evidence of washing.

TABLE 1.--*Approximate acreage in various uses, the total acreage, and the proportionate extent of the soils*

Soil	Cultivated	Pasture	Miscellaneous[1]	Total area	Extent
	Acres	*Acres*	*Acres*	*Acres*	*Percent*
Abilene clay loam, 0 to 1 percent slopes	66,600	6,000	2,500	75,100	13.3
Abilene clay loam, 1 to 3 percent slopes	8,100	3,350	350	11,800	2.1
Abilene clay loam, 1 to 3 percent slopes, eroded	1,750	500	50	2,300	.4
Abilene loam, 0 to 1 percent slopes	10,900	450	450	11,800	2.1
Abilene loam, 1 to 3 percent slopes	300	--	--	300	([2])
Abilene-Miles complex	24,250	450	900	25,600	4.6
Alluvial land	50	2,450	--	2,500	.4
Altus loamy fine sand	2,100	150	50	2,300	.4
Byrds clay, 0 to 1 percent slopes	200	600	--	800	.1
Byrds clay, 1 to 3 percent slopes	350	1,500	50	1,900	.3
Byrds clay, shallow, 0 to 3 percent slopes	400	1,750	50	2,200	.4
Cottonwood clay loam	--	200	--	200	([2])
Drake clay loam, 1 to 3 percent slopes	1,050	--	50	1,100	.2
Enterprise fine sandy loam, 1 to 3 percent slopes	500	300	--	800	.1
Enterprise fine sandy loam, 1 to 5 percent slopes, eroded	500	450	50	1,000	.2
Enterprise-Miles complex, 5 to 12 percent slopes	300	1,350	50	1,700	.3
Foard clay loam, 0 to 1 percent slopes	8,900	7,150	550	16,600	2.9
Foard clay loam, 1 to 3 percent slopes	2,500	3,500	200	6,200	1.1
Foard clay loam, 1 to 3 percent slopes, eroded	300	200	--	500	.1
Hollister clay loam, 0 to 1 percent slopes	15,450	2,700	650	18,800	3.3
Hollister clay loam, 1 to 3 percent slopes	1,650	1,650	100	3,400	.6
Mansker clay loam, 0 to 3 percent slopes	1,800	1,100	100	3,000	.5
Mansker clay loam, 1 to 5 percent slopes, eroded	1,450	1,150	100	2,700	.5
Miles loamy fine sand, undulating	19,100	1,200	600	20,900	3.7
Miles loamy fine sand, hummocky, eroded	8,200	1,100	300	9,600	1.7
Miles fine sandy loam, 0 to 1 percent slopes	6,700	550	250	7,500	1.3
Miles fine sandy loam, 1 to 3 percent slopes	2,300	200	100	2,600	.5
Miles fine sandy loam, 1 to 3 percent slopes, eroded	2,000	50	50	2,100	.4
Miles fine sandy loam, 3 to 5 percent slopes, eroded	400	400	--	800	.1
Miles fine sandy loam, 5 to 8 percent slopes, eroded	--	300	--	300	([1])
Miles fine sandy loam, undulating	13,250	200	550	14,000	2.5
Miles fine sandy loam, undulating, eroded	900	50	50	1,000	.2
Miller silty clay loam	2,400	12,100	300	14,800	2.6
Miller clay	350	5,350	200	5,900	1.0
Norwood silty clay loam	3,400	13,300	500	17,200	3.0
Owens clay, 1 to 3 percent slopes	--	1,000	--	1,000	.2
Portales fine sandy loam, 0 to 1 percent slopes	1,350	--	50	1,400	.2
Portales clay loam, 0 to 1 percent slopes	600	--	--	600	.1
Randall clay	1,850	100	50	2,000	.4
Roscoe clay, 0 to 1 percent slopes	23,200	3,850	950	28,000	4.9
Roscoe clay, 1 to 3 percent slopes	1,200	250	50	1,500	.3
Rough broken land, sandy	--	5,800	100	5,900	1.0
Rough broken land, clayey	--	1,600	--	1,600	.3
Sandy alluvial fans	100	700	--	800	.1
Springer loamy fine sand, undulating	11,000	3,700	400	15,100	2.6
Springer loamy fine sand, hummocky	200	3,050	50	3,300	.6
Springer-Altus loamy fine sands	3,500	500	100	4,100	.7
Spur soils	450	600	50	1,100	.2
Stamford clay, 1 to 3 percent slopes	1,300	4,300	200	5,800	1.0
Stamford clay, 3 to 5 percent slopes	100	1,500	--	1,600	.3
Stamford clay, 3 to 5 percent slopes, eroded	1,400	1,500	100	3,000	.5
Tarrant stony clay, 0 to 8 percent slopes	--	11,600	300	11,900	2.1
Tarrant stony clay, 8 to 20 percent slopes	--	10,900	300	11,200	2.0
Tillman clay loam, 0 to 1 percent slopes	7,100	6,100	400	13,600	2.4
Tillman clay loam, 1 to 3 percent slopes	30,300	24,600	1,700	56,600	9.9
Tillman clay loam, 1 to 3 percent slopes, eroded	5,300	1,850	250	7,400	1.3
Tillman clay loam, 3 to 5 percent slopes	100	500	--	600	.1
Tillman clay loam, shallow, 0 to 3 percent slopes	2,900	8,700	400	12,000	2.1
Tillman clay loam, shallow, 3 to 5 percent slopes	300	1,750	50	2,100	.4
Tillman clay loam, shallow, 1 to 5 percent slopes, eroded	5,500	3,200	300	9,000	1.6
Tillman-Foard complex, 0 to 1 percent slopes	2,400	4,100	200	6,700	1.2
Tipton loam, 0 to 1 percent slopes	1,750	700	50	2,500	.4
Valera clay, 0 to 1 percent slopes	500	4,050	150	4,700	.8
Valera clay, 1 to 3 percent slopes	1,300	4,300	200	5,800	1.0
Valera clay, shallow, 0 to 3 percent slopes	700	4,800	200	5,700	1.0
Valera stony clay, 0 to 3 percent slopes	--	1,350	50	1,400	.2
Vernon clay, 3 to 8 percent slopes	800	11,800	400	13,000	2.3
Vernon complex	100	12,560	400	13,060	2.3
Wichita clay loam, 0 to 1 percent slopes	8,650	1,200	350	10,200	1.8
Wichita clay loam, 1 to 3 percent slopes	4,200	2,300	200	6,700	1.3
Wichita clay loam, 1 to 3 percent slopes, eroded	950	150	--	1,100	.2
Wichita gravelly loam, 1 to 5 percent slopes	300	1,250	50	1,600	.3
Yahola fine sandy loam	400	400	--	800	.1
Water	--	--	--	5,200	.9
Total	328,200	218,360	17,200	568,960	100.0

[1] Acreage in towns, highway and railroad rights-of-way, cemeteries, gravel pits, and so on.
[2] Less than 0.1 percent.

The surface layer of the Abilene soils is dark grayish brown and has a texture of clay loam or lighter. The subsoil is clayey.

The Abilene soils occur with Hollister, Miles, Portales, Wichita, and Roscoe soils and are similar to those soils. They have a less clayey subsoil than the Hollister soils and developed in a different kind of parent material. The Abilene soils have a more clayey subsoil than the Miles soils. In contrast to the Miles and Wichita soils, their subsoil is brownish rather than reddish. At depths below about 18 inches, they are darker colored than the Portales soils. They also differ from the Portales soils in being noncalcareous rather than calcareous. The Abilene soils have a less clayey surface layer than the Roscoe soils.

Two soil types of this series--Abilene clay loam and Abilene loam--are represented in this county.

ABILENE CLAY LOAM

In this soil type the soils have a surface layer of very dark grayish-brown to dark grayish-brown clay loam that is about 8 inches thick. The uppermost 8 inches of the subsoil is very dark grayish-brown, crumbly, light clay, and the lower part is dark grayish-brown, sticky clay. A layer of reddish caliche occurs at a depth of about 48 inches. The parent material is reddish sandy clay or clay loam.

The following describes a typical profile in a cultivated field with less than one-half percent slope (4.85 miles northwest of the Haskell County Courthouse along farm road 2163, 30 feet west of the boundary of the field):

A_{1p} 0 to 8 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular and subangular blocky structure; hard when dry, friable when moist, and slightly sticky when wet; few fine roots; occasional hard concretions of calcium carbonate; noncalcareous; clear boundary.

B_1 8 to 15 inches, very dark grayish-brown (10YR 3/2), light clay, very dark brown (10YR 2/2) when moist; moderate, fine and medium, subangular blocky structure; very hard when dry, firm and very crumbly when moist, and sticky when wet; many fine pores; few roots; noncalcareous; gradual boundary.

B_2 15 to 27 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; moderate, medium, blocky structure with some subangular blocks in the upper part; very hard when dry, very firm but crumbly when moist, and very sticky when wet; a few hard concretions of calcium carbonate and iron manganese in the lower part; occasional quartzite pebbles; few roots; calcareous at a depth of 21 inches; gradual boundary.

B_3 27 to 43 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; moderate, medium, blocky structure; very hard when dry, firm but crumbly when moist, and very sticky when wet; many small, soft lumps of calcium carbonate; numerous lumps and concretions of iron manganese; few roots; strongly calcareous; diffuse boundary.

C_{ca} 43 to 71 inches, reddish-yellow (7.5YR 7/6), light clay, same color when moist; massive; hard when dry, firm but crumbly when moist; soft lumps and hard concretions of calcium carbonate comprise about 60 percent of the soil mass; numerous lumps of iron manganese; very strongly calcareous; diffuse boundary.

C 71 to 100 inches +, yellowish-red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) when moist; many medium, distinct mottles of light gray; massive; hard when dry, firm when moist; occasional large, soft lumps of calcium carbonate and iron manganese; weakly calcareous.

The A_{1p} horizon ranges in color from dark grayish brown to very dark grayish brown, in texture from clay loam to sandy clay loam or silty clay loam, and in thickness from 6 to 12 inches. The B_1 horizon ranges in color from very dark gray to very dark grayish brown, in texture from heavy clay loam to clay, and in thickness from 6 to 10 inches. Depth to the C_{ca} horizon ranges from 34 to 58 inches.

The Abilene clay loams are well suited to cotton, grain sorghum, wheat, and oats. Yields are high, except in dry years.

Abilene clay loam, 0 to 1 percent slopes (AcA).--This soil occurs in large, smooth areas in the north-central part of the county. It is the most extensive soil in the county.

Mapped with this soil are small areas occupied by Roscoe clays, Wichita clay loams, and Portales clay loams. These included soils do not occupy more than 2 percent of any one area.

Lack of moisture is the principal factor that limits yields on Abilene clay loam, 0 to 1 percent slopes. Capability unit IIc-1; range site, Deep Hardlands, Rolling Plains.

Abilene clay loam, 1 to 3 percent slopes (AcB).--Part of this soil is in fairly narrow areas adjacent to or surrounding small drainageways. Other sloping areas are between large areas of Abilene clay loam, 0 to 1 percent slopes, which are at different elevations. The surface soil is 5 to 8 inches thick. Depth to the layer of caliche ranges from 30 to 48 inches.

Mapped with this soil are small, narrow areas of Mansker clay loams. The included soils do not occupy more than 5 percent of any one area.

If cultivated, Abilene clay loam, 1 to 3 percent slopes, has a slight to moderate hazard of water erosion. Capability unit IIe-2; range site, Deep Hardlands, Rolling Plains.

Abilene clay loam, 1 to 3 percent slopes, eroded (AcB2).--Except for having been eroded by water, this soil is similar to Abilene clay loam, 1 to 3 percent slopes. Gullies about 100 yards apart have cut into the subsoil. Between the gullies, sheet erosion has removed all but 3 to 6 inches of the surface soil.

Mapped with this soil are small areas of Mansker clay loams and Abilene loams. These included soils do not occupy more than 10 percent of any one area.

Controlling erosion is the main problem in farming Abilene clay loam, 1 to 3 percent slopes, eroded.

Capability unit IIIe-2; range site, Deep Hardlands, Rolling Plains.

ABILENE LOAM

The surface layer in this soil type consists of brown loam that is 4 to 10 inches thick. The uppermost 6 to 10 inches of the subsoil is dark grayish-brown, friable and crumbly sandy clay loam; below this is dark grayish-brown, sticky clay. Depth to the layer of caliche ranges from 46 to 60 inches.

The following describes a profile in a nearly level, cultivated field (4.5 miles east of O'Brien, 0.5 mile east and 100 yards south of the county roads, and 0.5 mile south of the county line):

A_p 0 to 8 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; slightly hard when dry, friable when moist; pH 7.5; abrupt boundary.

B_1 8 to 16 inches, dark grayish-brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) when moist; weak to moderate, medium and fine, subangular blocky structure; hard when dry, friable when moist, and slightly sticky when wet; many medium pores; pH 7.5; diffuse boundary.

B_2 16 to 34 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; moderate, medium and fine, blocky and subangular blocky structure; very hard when dry, very firm when moist, and sticky when wet; calcareous; clear boundary.

B_3 34 to 46 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; moderate, medium, blocky structure; very hard when dry, very firm when moist, and sticky when wet; numerous medium-sized, soft lumps of calcium carbonate; gradual boundary.

C_{ca} 46 to 58 inches, mottled brown (7.5YR 5/4), dark-brown (7.5YR 4/4), and yellowish-red (5YR 4/6) clay, yellowish red (5YR 3/6) when moist; massive; very hard when dry, firm when moist, and sticky when wet; medium-sized, distinct, soft lumps of calcium carbonate comprise about 20 percent of the total volume; strongly calcareous; diffuse boundary.

C 58 to 76 inches+, mottled red, yellowish-red, brown, and light-gray clay; massive; very hard when dry, firm when moist, and sticky when wet; few soft lumps of calcium carbonate; many concretions of iron manganese; weakly calcareous.

The A_p horizon ranges from 4 to 10 inches in thickness, from brown to dark grayish brown in color, and from loam to fine sandy loam in texture. The B_1 horizon ranges from dark brown to dark grayish brown in color, from sandy clay loam to light clay in texture, and from 6 to 10 inches in thickness. Depth to the C_{ca} horizon ranges from 46 to 60 inches.

Abilene loam, 0 to 1 percent slopes (AdA).--This nearly level soil occurs between areas of Abilene clay loams and Miles fine sandy loams.

Mapped with this soil are small areas of Abilene clay loams and Miles fine sandy loams. These included soils do not occupy more than 5 percent of any one area.

If Abilene loam, 0 to 1 percent slopes, is used for crops, there is a slight hazard of wind erosion. Capability unit IIc-1; range site. Deep Hardlands, Rolling Plains.

Abilene loam, 1 to 3 percent slopes (AdB).--Most of this soil occurs on the slopes into playas and on slopes that lie between the smooth, higher lying Abilene soils and the gently rolling soils of the red beds.

If this soil is used for crops, there is risk of erosion by water and wind. Capability unit IIe-2; range site, Deep Hardlands, Rolling Plains.

Abilene-Miles complex (Ae).--The soils of this complex are among the most productive in the county. The complex is made up mainly of Miles fine sandy loams, which are on mounds, and of nearly level areas of Abilene fine sandy loams that lie between the mounds. Included are small areas of Abilene clay loams, which are on flats, and of Springer fine sandy loams, which are on small mounds. Springer fine sandy loams are not mapped separately in this county. The areas of each soil in the complex are too small and intermixed to map separately. Each area generally consists of about 45 percent Abilene, 40 percent Miles, and 15 percent Springer soils. This complex is in the northwestern part of the county.

The mounds occupied by Miles and Springer soils range from 1 to 4 feet in height and from less than 1 acre to more than 3 acres in size. They were probably formed by wind many years ago. Many of them are underlain by former Abilene soils.

In wet seasons water sometimes ponds between the mounds. Terracing would be desirable, but it is not practicable without leveling, which is not now feasible in most areas. If the areas are not leveled, the soils need to be irrigated by using a sprinkler system. Capability unit IIe-1; range site, Mixed Land, Rolling Plains.

Alluvial Land

Alluvial land is made up of a mixture of sandy soils with no definite characteristics. The material is brownish and is dominantly sandy, but it includes thin strata of silt loam, silty clay loam, and clay. The areas are flooded occasionally.

Alluvial land (Al).--This miscellaneous land type lies next to the channel of the Double Mountain Fork of the Brazos River; the largest areas are in the bends of the river channel. Alluvial land is not suited to crops, but good to excellent pastures can be established on it. In 1955, many of the areas were covered by as much as 3 feet of sand, which was deposited by floodwaters. In unprotected areas wind erosion is moderate to severe. Capability unit VIe-4; range site, Bottom Land, Rolling Plains.

Altus Series

The Altus series consists of deep, dark, noncalcareous, sandy soils that have a dark, clayey subsoil. The soils are in small, nearly level areas or in slight depressions. They developed from

outwash material of Quaternary age. The native vegetation was mesquite trees and mid and tall grasses.

The Altus soils occur near the Miles, Springer, and Abilene soils. They have a more grayish subsoil than the Springer and Miles soils and are deeper and lighter textured than the Abilene soils.

ALTUS LOAMY FINE SAND

In this soil type the soils have a surface layer that is brown to dark brown and 18 to 34 inches thick. The subsoil is very dark grayish-brown, sticky clay but is more clayey in the lower than in the upper part. The underlying material is light-gray, calcareous fine sandy loam.

The following describes a profile in a nearly level, cultivated field (6.7 miles west of Rochester, 0.7 mile west of the intersection of farm roads 617 and 2279, and 0.25 mile south of farm road 2279):

A_{1p} 0 to 10 inches, brown (10YR 4/3), heavy loamy fine sand, dark brown (10YR 3/3) when moist; structureless; soft when dry, very friable when moist; pH 7.0; abrupt boundary.

A_{12} 10 to 34 inches, brown (7.5YR 4/3) fine sandy loam, dark brown (7.5YR 3/3) when moist; structureless; many medium pores; very hard when dry, but friable when moist; pH 7.5; gradual boundary.

B_1 34 to 42 inches, very dark grayish-brown (10YR 3/2), light sandy clay, very dark brown (10YR 2/2) when moist; weak to moderate, medium, subangular blocky structure; many fine pores; very hard when dry, friable when moist, and slightly sticky when wet; pH 7.5; clear boundary.

B_2 42 to 54 inches, very dark gray (10YR 3/1), light clay, black (10YR 2/1) when moist; compound, moderate, medium, angular and subangular blocky structure; very hard when dry, firm but crumbly when moist, and sticky when wet; patchy clay skins; pH 7.5; gradual boundary.

C 54 to 60 inches +, light-gray (10YR 7/1) fine sandy loam, gray (10YR 6/1) when moist; structureless; friable; calcareous.

The A_{1p} horizon ranges in texture from heavy loamy fine sand to light loamy fine sand. The B_1 horizon ranges in color from brown to very dark grayish brown and in texture from clay to clay loam or sandy clay. The B_1 horizon is 8 to 16 inches thick.

Altus loamy fine sand (At).--This soil occurs in nearly level, concave areas near areas of Miles loamy fine sands and Springer loamy fine sands. Much of the fine silt and clay that was once in the uppermost 8 to 10 inches of the soil has been sifted and blown away by wind.

Mapped with this soil are a few areas in which there is a C_{ca} horizon at a depth between 18 and 24 inches. The presence and depth of the C_{ca} horizon is erratic. These included areas are near areas in which the soil is like the profile described but are to the east and south; they make up less than 1 percent of the total acreage of this soil. Also included are small mounds occupied by Springer loamy fine sands.

The most serious hazard in cropping Altus loamy fine sand is its susceptibility to wind erosion. Consequently, although cotton and sorghum both make good yields, sorghum is more desirable because it gives better protection from wind erosion. Capability unit IIIe-6; range site, Sandy Land, Rolling Plains.

Byrds Series

The Byrds series consists of moderately deep, reddish, noncalcareous, clayey soils that are underlain by limestone. The soils are on broad divides. In gently sloping areas that have been cultivated, the soils are slightly eroded and there are rills and other evidence of washing. The native vegetation was short grasses.

The Byrds soils occur near Valera and Tarrant soils. They are more reddish and less crumbly than the Valera soils and are deeper than the Tarrant soils, which are very stony. Byrds soils are similar to the Tillman and Stamford soils, which have developed in clay of the Permian red beds.

BYRDS CLAY

The Byrds clays consist mainly of reddish-brown, blocky, sticky clay, 20 to 40 inches thick, that rests on broken limestone. In places where the layer of clay is thicker than 40 inches the lower part is less dark and more yellowish than in the typical profile.

The following describes a typical profile in a native pasture (on the east side of a county road, just north of the corner of the road and 1.65 miles south of the headquarters of the Brooks Early Ranch):

A_{11} 0 to 10 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) when moist; compound, weak, prismatic and moderate, medium, blocky structure; very hard when dry, very firm when moist, and very sticky and plastic when wet; many roots; noncalcareous; gradual boundary.

A_{12} 10 to 26 inches, same as the A_{11} horizon, except that the structure in this horizon is moderate, medium, blocky; abrupt boundary.

C 26 inches +, broken limestone.

The A_{11} horizon ranges from reddish brown to dark reddish brown in color and from 8 to 15 inches in thickness. In small areas the soil is calcareous throughout.

Nearly all of the acreage is used for range, to which the soils are well suited. The soils can also be used for crops, especially for small grains and sorghum. Yields are moderate.

Byrds clay, 0 to 1 percent slopes (BcA).--This soil is well suited to range. The grass is nutritious and makes good yields.

Mapped with this soil are small areas of shallow Byrds clays and of Valera soils. These included soils occupy 10 percent or less of any one area.

If the soil is used for crops, good management is required because of the moderately poor plant-soil-

moisture relationships. Capability unit IIS-1; range site, Deep Hardlands, Rolling Plains-Limestone.

Byrds clay, 1 to 3 percent slopes (BcB).--Except for slope, this soil is similar to Byrds clay, 0 to 1 percent slopes. Mapped with it are areas of shallow Byrds clays. These included areas do not occupy more than 15 percent of any one area. Small areas of shallow Valera clays are also mapped with this soil.

If cultivated, Byrds clay, 1 to 3 percent slopes, requires practices to control runoff and to prevent erosion. Capability unit IIe-4; range site, Deep Hardlands, Rolling Plains-Limestone.

BYRDS CLAY, SHALLOW

The shallow Byrds clays have a surface layer of reddish-brown, light clay, 4 to 8 inches thick, that grades to a subsoil of dark reddish-brown, sticky clay. Underlying this is a bed of broken limestone.

The following describes a profile in a cultivated field (near the intersection of roads running south and east, 2.3 miles south of the headquarters of the Brooks Early Ranch):

A_{1p} 0 to 5 inches, reddish-brown (5YR 4/4), light clay, dark reddish brown (5YR 3/4) when moist; moderate, fine, subangular blocky and granular structure; very hard when dry, very firm but crumbly when moist, and very sticky when wet; many very fine pores; many fine roots; alkaline but noncalcareous; clear boundary.

A_{12} 5 to 15 inches, dark reddish-brown (5YR 3/4) clay, (5YR 2/4, when moist); moderate to strong, medium, subangular and angular blocky structure; very hard when dry; more firm and sticky than the A_{1p} horizon; many very fine pores; noncalcareous; abrupt boundary.

C 15 inches +, broken limestone with a coating of indurated calcium carbonate.

The A horizons range from reddish brown to dark reddish brown in color. Depth to limestone ranges from 8 to 20 inches.

Most of the acreage is in range, but it can be cultivated. Small grains are the crops best suited. Because the depth to limestone varies, care is required to avoid very shallow places if terraces are to be built.

Byrds clay, shallow, 0 to 3 percent slopes (ByB).--Because of the shallow depth over limestone, the development of roots is limited in this soil and it has a limited capacity for storing water.

Mapped with this soil are areas in which the surface layer is clay loam 4 to 5 inches thick. Also included are small areas of shallow Valera clays and of normal Byrds clays, which have limestone at a depth of 20 inches or more. These included soils do not occupy more than 15 percent of any one area. They occupy no more than 5 percent of the total acreage.

Grass grows well on Byrds clay, shallow, 0 to 3 percent slopes, and is nutritious. In places where slopes are 1 percent or more, practices are required to reduce runoff and conserve moisture if the soil is used for crops. Capability unit IIIe-3; range site, Shallow Land, Rolling Plains-Limestone.

Cottonwood Series

The soils of the Cottonwood series have a brownish color and are stongly calcareous. They are shallow and are nearly level to sloping. These soils occur in the southwestern part of the county. They developed under a sparse cover of short grasses and shrubs.

The Cottonwood soils occur near the Abilene, Foard, Hollister, and Tillman soils. Unlike these associated soils, they are underlain by beds of impure gypsum. They are also shallower than any of these soils.

Only one soil type of this series--Cottonwood clay loam--is represented in this county.

COTTONWOOD CLAY LOAM

In this soil type the soils have a brown, strongly calcareous surface layer. The surface layer is underlain by pale-brown, strongly calcareous, impure gypsum.

The following describes a typical profile in a native pasture (6.7 miles south of Rule and 0.1 mile east of State Highway 283, on the east side of the pipeline right-of-way):

A 0 to 5 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; soft when dry, friable and very crumbly when moist; strongly calcareous; abrupt boundary.

C_{cs} 5 to 20 inches +, very pale brown (10YR 8/3) silty clay loam, (10YR 7/3, when moist); contains much gypsum; massive; very strongly calcareous.

The A horizon ranges from brown to grayish brown in color, from loam to clay loam in texture, and from 2 to 10 inches in thickness. The amount of gypsum and lime in the C_{cs} horizon varies from place to place.

Cottonwood clay loam (Cc).--This soil occurs on a few narrow ridges and on small bluffs along drainageways. Most of it has slopes of less than 2 percent.

Mapped with this soil are a few areas of Acme soil in which the C_{cs} horizon occurs at a depth of more than 20 inches; Acme soils are not mapped separately in Haskell County.

Cottonwood clay loam is not suited to crops, but in a few small areas it is cultivated along with deeper soils. Capability unit VIe-3; range site, Shallow Hardlands, Rolling Plains.

Drake Series

The soils of the Drake series are light colored and are strongly calcareous. They are gently sloping and are on low, stabilized dunes on the east side of some of the playas. The soils developed under a cover of short grasses.

The Drake soils are similar to and occur near the Abilene and Mansker soils. They are shallower

and lighter colored than the Abilene soils and are deeper than the Mansker soils. In addition, the Mansker soils have a distinct layer of caliche in the profile.

Only one soil type of this series--Drake clay loam--is represented in the county.

DRAKE CLAY LOAM

The upper part of the profile of this soil type is grayish brown to light brownish gray and is strongly calcareous to a depth between 12 and 16 inches. Below this is light-gray, crumbly clay loam, 4 to 6 feet thick, that is strongly calcareous.

The following describes a typical profile in a cultivated field on a convex slope of 1-1/2 percent on a low, stabilized dune on the east side of a small playa (12 miles north of Haskell, 1 mile south of farm road 617, and 100 feet west of farm road 2163):

A_{1p} 0 to 5 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular and subangular blocky structure; hard when dry, friable and crumbly when moist, and sticky when wet; numerous small, hard concretions of calcium carbonate, 1/4 to 1/2 inch in diameter, on the surface; very strongly calcareous; clear boundary.

A_{11} 5 to 14 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) when moist; moderate, fine and very fine, subangular blocky structure; hard when dry, firm but crumbly when moist, and very sticky when wet; very strongly calcareous; gradual boundary.

C 14 to 54 inches +, light-gray (10YR 7/2) clay loam, pale brown (10YR 6/3) when moist; same as the A_{11} horizon, except that there are a few soft lumps of calcium carbonate in the uppermost few inches of this horizon.

The A horizons range in color from grayish brown to light brownish gray, in texture from clay loam to loam, and in thickness from 10 to 16 inches.

Drake clay loams are not well suited to crops. Yields are generally low but are even lower in dry seasons. Sorghum is damaged by chlorosis, especially when the plants are young. This is shown by the yellowing of the leaves.

Drake clay loam, 1 to 3 percent slopes (DrB).--This soil is on ridges on low, stabilized dunes on the east side of some of the playas. If it is cropped and then left unprotected, it is subject to moderate erosion by wind and water. Capability unit IIIe-7; range site, Mixed Land, Rolling Plains.

Enterprise Series

The Enterprise series consists of brownish, alkaline soils that have developed in beds of sandy and silty materials. The materials probably originated in local riverbeds and were blown onto the areas by wind. Bunch grasses were the native vegetation.

In nearly all of the fields that have been cultivated, the material in the uppermost 4 to 6 inches of the surface layer has been winnowed or sifted by wind. Rills and other evidence of washing indicate that slight water erosion has occurred on the gentle slopes in cultivated fields.

The Enterprise soils are near areas of Miles, Springer, and Tipton soils. In color they are similar to these soils, but their surface layer is coarser textured than that of the Tipton soils and finer textured than that of the Miles and Springer soils. Unlike these associated soils, the Enterprise soils lack a textural profile.

Only one soil type of this series--Enterprise fine sandy loam--is represented in the county.

ENTERPRISE FINE SANDY LOAM

In this soil type the soils have a surface layer that is brownish and sandy. The surface layer is not calcareous. The subsoil is reddish and sandy and is calcareous.

The following describes a profile in the northeastern corner of a yard in an old field (9 miles west of O'Brien on farm road 2229 and 2.6 miles north on farm road, 2279, on the west side of an old county road):

A_{11} 0 to 16 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) when moist; weak, fine, granular structure; soft when dry, very friable when moist, and nonsticky when wet; many medium and coarse pores; pH 8.0; diffuse boundary.

A_{12} 16 to 32 inches, reddish-brown (5YR 5/4) fine sandy loam, (5YR 4/4, when moist); weak, coarse, prismatic and fine, granular structure; soft when dry, very friable when moist, and nonsticky when wet; calcareous; diffuse boundary.

AC 32 to 54 inches +, same as the A_{12} horizon, except that the soil material is structureless.

The A_{11} horizon ranges from brown to reddish brown in color and from 12 to 20 inches in thickness.

All of the crops suited to the climate can be grown on soils of this type, and most of the soils are cultivated. The soils retain moisture well, and crops can be grown even in dry years.

Enterprise fine sandy loam, 1 to 3 percent slopes (EnB).--This soil is well suited to crops, but it is likely to be eroded by wind. Capability unit IIIe-5; range site, Mixed Land, Rolling Plains.

Enterprise fine sandy loam, 1 to 5 percent slopes, eroded (EnC2).--This soil occurs on slopes between nearly level areas of other Enterprise soils and Tipton soils. It has been eroded considerably by water and somewhat eroded by wind. The soil is not suitable for terracing. Capability unit IVe-3; range site, Mixed Land, Rolling Plains.

Enterprise-Miles complex, 5 to 12 percent slopes (EpD).--This complex consists of Enterprise and Miles soils that are too intermixed to map separately. Mapped with these soils are small areas of gravelly Enterprise and Miles soils on ridges and in pockets.

Areas of this complex were formed as the result of erosion caused by the Brazos River cutting

through the mantle of Quaternary outwash to form the present valley of the river. The soils of this complex are on slopes flanking the river bottom. In places the underlying red beds have been exposed by erosion. Capability unit VIe-1; range site, Mixed Land, Rolling Plains.

Foard Series

The Foard series consists of deep, dark-colored soils that have a subsoil of heavy clay resembling a pan. They have developed in clay from the red beds. The original vegetation was a dense cover of short grasses. Some areas of these soils are large and nearly level, and others are small and gently sloping. In the gently sloping areas that have been cultivated, there are rills and other evidence of washing.

The Foard soils are similar to or occur near Abilene, Hollister, Roscoe, Stamford, and Tillman soils. They lack the distinct B_1 horizon characteristic of the Abilene and Hollister soils and have a less clayey surface layer and a more pronounced textural profile than the Roscoe and Stamford soils. They are brownish rather than being reddish like the Stamford and Tillman soils.

Only one soil type of this series--Foard clay loam--is represented in this county.

FOARD CLAY LOAM

In this soil type the soils have a surface layer of dark-brown, noncalcareous clay loam that is 4 to 10 inches thick. The surface layer rests abruptly on the dark-brown, blocky, heavy clay subsoil that has a few soft lumps of lime in the lower part. Below the subsoil is reddish, strongly calcareous clay that contains numerous small, soft lumps of lime. The parent material is clay and shale of the red-bed formations. A profile of Foard clay loam is shown in figure 2.

The following describes a profile in a native pasture, on a slope of about one-half percent (9.9 miles east of Haskell and 0.3 mile south of State Highway 24, on the west side of the county road):

A_1 0 to 6 inches, dark-brown (7.5YR 3/2) clay loam, very dark brown (7.5YR 2/2) when moist; strong, fine, subangular blocky structure; many fine pores; extremely hard when dry, firm but crumbly when moist, and sticky when wet; layer of platy silt loam, half an inch thick, on the surface; numerous grass roots; noncalcareous; abrupt boundary.

B_{21} 6 to 26 inches, dark-brown (7.5YR 3/2) clay, very dark brown (7.5YR 2/2) when moist; moderate, medium and coarse, irregular blocky structure; extremely hard when dry, very firm when moist, and very sticky and plastic when wet; very dense; no fine pores; continuous clay films; few roots between and through peds; noncalcareous; gradual boundary.

B_{22} 26 to 38 inches, dark-brown (7.5YR 3/2) clay, very dark brown (7.5YR 2/2) when moist; weak, coarse, blocky structure; consistence similar to that in B_{21} horizon; few small, soft lumps of calcium carbonate; few fine roots; noncalcareous; gradual boundary.

C_{ca} 38 to 50 inches, dark reddish-brown (5YR 3/4) clay, (5YR 2/4, when moist); massive; consistence same as that in B_{21} horizon; small, soft lumps of calcium carbonate comprise about 1 percent of the soil mass; strongly calcareous; gradual boundary.

C 50 to 60 inches+, red (2.5YR 4/6) clay from red beds, dark red (2.5YR 3/6) when moist; massive; very firm and sticky; strongly calcareous.

Figure 2.—Profile of Foard clay loam that has been exposed long enough to show crusting; cracks show blocky structure of the B horizon.

The A_1 horizon ranges from brown to dark brown in color and from clay loam to silty clay loam in texture. It ranges from 4 to 10 inches in thickness. The B_{21} and B_{22} horizons range from brown to dark brown in color. Depth to the C_{ca} horizon ranges from 30 to 46 inches.

If cultivated, Foard clay loams are best suited to small grains, but cotton makes fair yields. A good seedbed is difficult to prepare in these soils. A hard crust forms on the surface after heavy rains, and, because of the dense subsoil, the soils are droughty. Stubble mulching will help to prevent crusting and will improve tilth.

Foard clay loam, 0 to 1 percent slopes (FcA).--This soil occurs in large, nearly level areas in the southern and eastern parts of the county. Mapped with the soil are small areas of Hollister and Tillman clay loams. These included soils do not occupy more than 2 percent of any one area.

The hazard of water and wind erosion on Foard clay loam, 0 to 1 percent slopes, is slight even if the soil is cultivated and left unprotected. Capability unit IIs-2; range site, Deep Hardlands, Rolling Plains.

Foard clay loam, 1 to 3 percent slopes (FcB).--Except for slope, this soil is similar to Foard clay loam, 0 to 1 percent slopes. It occupies gently sloping areas between large, nearly level areas of Foard clay loams that occur at different elevations. It is also on gentle slopes next to small drainageways.

Mapped with this soil are small areas of Hollister, Tillman, and Tillman, shallow, soils. The Tillman soils are mostly in areas where the slope is about 3 percent. The included soils do not occupy more than 5 percent of any one area.

Foard clay loam, 1 to 3 percent slopes, is likely to be moderately eroded by water if it is cultivated and left unprotected. Capability unit IIIe-1; range site, Deep Hardlands, Rolling Plains.

Foard clay loam, 1 to 3 percent slopes, eroded (FcB2).--Except for erosion, this soil is similar to Foard clay loam, 1 to 3 percent slopes. It occupies similar areas. Gullies, about 200 to 300 feet apart, have cut into the subsoil. Sheet erosion has removed all but 3 or 4 inches of the surface soil.

Mapped with this soil are small areas of Hollister, Tillman, and Tillman, shallow, soils. The Hollister soils make up as much as 15 percent of the acreage in some areas, but the Tillman soils do not occupy more than 5 percent of any one area.

Foard clay loam, 1 to 3 percent slopes, eroded, is more droughty than the other Foard soils in the county. Capability unit IIIe-1; range site, Deep Hardlands, Rolling Plains.

Hollister Series

The Hollister series consists of deep, dark, noncalcareous soils that have a subsoil of heavy clay. Most areas are large and nearly level, but some are small and gently sloping. The soils developed under a cover of short grasses in clay from the red beds. The gently sloping areas that have been cultivated are slightly eroded, and there are rills and other evidence of washing.

The Hollister soils occur near the Abilene, Foard, Roscoe, Stamford, and Tillman soils. They formed from more clayey parent materials and have a more clayey subsoil than the Abilene soils. Their A_1 and B_1 horizons are also thinner than those of the Abilene soils. The Hollister soils are less clayey than the Roscoe and Stamford soils, and the Roscoe and Stamford soils do not have a textural profile. Unlike the Stamford and Tillman soils, which have a reddish color, the Hollister soils are dark brown.

Only one soil type of this series--Hollister clay loam--is represented in the county.

HOLLISTER CLAY LOAM

In this soil type the soils have a surface layer of dark-brown, crumbly clay loam that is noncalcareous and is 4 to 7 inches thick. The subsoil is dark-brown clay. It is distinctly more crumbly in the uppermost 4 to 6 inches than in the lower part, which is blocky and sticky. At depths below 30 to 36 inches, the subsoil is reddish and has few to many small, soft lumps of lime.

The following describes a profile in a native pasture west of a farm road, about 150 feet southwest of the northeast corner on a slightly convex slope of about one-half of 1 percent (8.5 miles east of Haskell and 5 miles north of State Highway 24):

A_1 0 to 6 inches, dark-brown (7.5YR 3/2) clay loam, very dark brown (7.5YR 2/2) when moist; moderate, medium and coarse, subangular blocky and weak, fine, granular structure; hard when dry, friable when moist, and slightly sticky when wet; many medium and fine pores; many fine roots; some worm activity; noncalcareous; gradual boundary.

B_1 6 to 14 inches, dark-brown (7.5YR 3/2), light clay, very dark brown (7.5YR 2/2) when moist; moderate to strong, medium, subangular blocky structure; hard when dry, firm when moist, and sticky when wet; many fine pores; distinct clay films; many fine roots; noncalcareous; gradual boundary.

B_2 14 to 32 inches, dark-brown (7.5YR 3/4) clay, very dark brown (7.5YR 2/4) when moist; compound prismatic and moderate, medium, blocky structure; very hard when dry, very firm when moist, and very sticky when wet; few fine concretions of iron manganese; moderate number of fine roots in upper part of this horizon between and through the peds; noncalcareous; gradual boundary.

B_3 32 to 50 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) when moist; weak, coarse, blocky structure; very hard when dry, very firm when moist, and very sticky when wet; many common, indistinct, soft lumps of calcium carbonate; few fine concretions of iron manganese; very few roots; weakly calcareous; diffuse boundary.

C_{ca} 50 to 62 inches, reddish-brown (5YR 5/4) clay, (5YR 4/4, when moist); massive; same consistence as that in B_3 horizon; many common, distinct, soft lumps of calcium carbonate; few fine concretions of iron manganese; strongly calcareous; diffuse boundary.

C 62 to 72 inches +, light-red (2.5YR 6/6) clay, red (2.5YR 5/6) when moist; sand grains noticeable; massive; few small, soft lumps of calcium carbonate; strongly calcareous.

The A_1 horizon ranges from brown to dark brown in color, from clay loam to silty clay loam in texture, and from 4 to 8 inches in thickness. The B_1 horizon ranges from heavy clay loam to light clay in texture and from 4 to 6 inches in thickness. In some places the distinct C_{ca} horizon is lacking. Depth to this horizon ranges from 38 to 58 inches.

Hollister clay loams are well suited to cotton, to wheat and oats, and to sorghum grown for grain or fodder. Crop yields are lowered by lack of moisture in dry years. The soils absorb water slowly and have high water-holding capacity, but much of the water they retain is not available to plants.

Hollister clay loam, 0 to 1 percent slopes (HoA).--This soil occupies large, smooth areas, mainly in the southwestern part of the county. More than 80 percent of it is cultivated. Many freshly plowed areas have a spotted appearance because of a gilgai condition that occurred when the soil was still in native grass. Such areas are locally known as hog wallows.

Mapped with this soil are small areas of Foard and Tillman soils. The included soils do not occupy more than 2 percent of any one area.

Nearly all crops suited to the climate are grown on Hollister clay loam, 0 to 1 percent slopes. Capability unit IIc-1; range site, Deep Hardlands, Rolling Plains.

Hollister clay loam, 1 to 3 percent slopes (HoB).--Areas of this soil are generally long and fairly narrow. They occur between drainageways and large, smooth areas of Hollister clay loam, 0 to 1 percent slopes.

Mapped with this soil are small areas of Foard, Tillman, and Tillman, shallow, soils. The Tillman, shallow, soils generally occur at the crests of slopes. The included soils do not occupy more than 5 percent of any one area.

Hollister clay loam, 1 to 3 percent slopes, is likely to be eroded by water if it is not managed carefully. All of the crops suited to the climate can be grown on this soil. Capability unit IIe-2; range site, Deep Hardlands, Rolling Plains.

Mansker Series

The Mansker series consists of grayish-brown, strongly calcareous soils. The soils are shallow and have developed under short grasses from strongly calcareous, fine-textured to medium-textured sediments. In most places some of the finer silty and clayey particles that once were in the uppermost 3 to 4 inches of the soils have been removed through winnowing and sifting by wind. In cultivated fields these soils on gentle slopes are slightly eroded and there are rills and other evidence of washing.

These soils occur near Abilene clay loams. They are shallower than those soils, and the surface layer of the Abilene clay loams is generally noncalcareous. The Mansker soils are similar to the Portales soils, but depth to the layer of caliche is less than in the Portales soils.

Only one soil type of this series--Mansker clay loam--is mapped in the county.

MANSKER CLAY LOAM

In this soil type the soils have a brown, strongly calcareous surface layer that is 6 to 10 inches thick. The subsoil is darker brown, very crumbly, heavy clay loam that is also strongly calcareous. Depth to the layer of caliche is 10 to 24 inches. The layer of caliche is light brown and contains many soft lumps and hard concretions of lime.

The following describes a profile in a cultivated field on a slope of 3 percent (2.4 miles west of Haskell and 0.2 mile north of State Highway 24):

A_{1p} 0 to 4 inches, brown (7.5YR 5/3) clay loam, dark brown (7.5YR 4/3) when moist; weak, fine, granular structure; slightly hard when dry, friable and very crumbly when moist, and slightly sticky when wet; many small concretions of calcium carbonate in the soil and on the surface; strongly calcareous; abrupt boundary.

A_{12} 4 to 10 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; weak, fine, subangular blocky structure; same consistence as that in A_{1p} horizon; many fine pores; many fine concretions of calcium carbonate; strongly calcareous; clear boundary.

AC 10 to 18 inches, brown (7.5YR 5/4), heavy clay loam, (7.5YR 4/4, when moist); moderate, medium and fine, subangular blocky and granular structure; hard when dry, very crumbly when moist, and sticky when wet; many fine pores; numerous fine concretions of calcium carbonate; strongly calcareous; clear boundary.

C_{ca} 18 to 34 inches, light-brown (7.5YR 6/4) clay loam, color the same when moist; weak, subangular blocky and granular structure; friable when moist, slightly sticky when wet; large, soft lumps of calcium carbonate make up about 30 percent, by volume, of the soil mass; a few lumps of iron manganese; gradual boundary.

C 34 to 40 inches +, same as the C_{ca} horizon, except that this horizon contains much less calcium carbonate.

The A horizons range from brown to light brown in color, from loam to clay loam in texture, and from 6 to 10 inches in thickness. The AC horizon ranges from clay loam to light clay in texture. The C_{ca} horizon ranges in depth from 10 to 24 inches, and in color, from very pale brown to reddish yellow.

The soils in this soil type are droughty and are not well suited to crops. They are better suited to small grains and similar crops, which grow best in cool seasons, than to other crops. Because the layer of caliche is at a shallow depth, the development of roots is limited in the soils; their capacity for holding water is also limited.

Mansker clay loam, 0 to 3 percent slopes (MaB).--This soil occurs in small areas in most parts of the county. Areas of the soil that have slopes of more than about 1 percent are likely to be eroded by runoff. If the soil is not protected during the blowing season, it is likely to be damaged slightly as the result of wind erosion. Capability unit IIIe-7; range site, Shallow Hardlands, Rolling Plains.

Mansker clay loam, 1 to 5 percent slopes, eroded (MaC2).--This soil, unlike Mansker clay loam, 0 to 3 percent slopes, has been damaged by water erosion. In most places about 3 to 4 inches of the soil above the layer of caliche is gone. In some places runoff has cut gullies in the soil. Mapped

with this soil are small areas in which hard caliche is at a depth of only a few inches.

Mansker clay loam, 1 to 5 percent slopes, eroded, is best suited to small grains, but yields are low. Capability unit IVe-2; range site, Shallow Hardlands, Rolling Plains.

Miles Series

The Miles series consists of deep, reddish, sandy, noncalcareous soils that have a subsoil of red sandy clay loam. The soils occur in large areas where the topography is undulating to hummocky. They developed under bunch grasses in sandy material from Quaternary outwash.

The Miles soils occur with the Abilene, Enterprise, Portales, and Springer soils. Unlike the Miles soils, the Abilene soils have a dark-gray subsoil, the Enterprise and Springer soils have subsoils of fine sandy loam, and the Portales soils are brownish and are strongly calcareous throughout.

Two soil types of this series--Miles loamy fine sand and Miles fine sandy loam--are represented in this county.

MILES LOAMY FINE SAND

The surface layer in soils of this type is brown, fairly loose sand. It is 10 to 18 inches thick and grades to the subsoil of yellowish-red sandy clay loam. In places reddish, limy material occurs at a depth of 6 or 7 feet.

The following describes a profile from an area that has a convex surface in a cultivated field (4.2 miles west of O'Brien along farm road 2229 and 100 yards south of the road on the west side of a fence):

A_{1p} 0 to 14 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 3/4) when moist; structureless; soft when dry, very friable when moist; pH 7.0; abrupt boundary.

B_2 14 to 44 inches, yellowish-red (5YR 4/6) sandy clay loam, (5YR 3/6, when moist); compound weak, coarse, prismatic and weak, coarse, subangular blocky structure; very hard when dry, firm when moist, and sticky when wet; many fine pores; pH 6.5; diffuse boundary.

B_3 44 to 82 inches, sandy clay loam that is the same color as the B_2 horizon; massive; hard when dry, firm when moist, but not so firm as in the B_2 horizon, and sticky when wet; many fine pores; few very small, hard concretions of calcium carbonate and films of lime in the lower few inches; soil mass is noncalcareous; clear boundary.

C_{ca} 82 to 98 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) when moist; massive; consistence same as that in the B_3 horizon; many coarse, hard concretions and soft lumps of calcium carbonate make up about 15 percent, by volume, of the soil mass; a few small concretions of iron manganese; very strongly calcareous; diffuse boundary.

C 98 to 108 inches +, light sandy clay loam that is the same color as the C_{ca} horizon; massive; less hard, firm, or sticky than the soil material in the C_{ca} horizon; few coarse, soft lumps of calcium carbonate; strongly calcareous.

The A_{1p} horizon ranges from 10 to 18 inches in thickness. In areas that have been deep plowed, the A_{1p} horizon has an abrupt lower boundary; where plowing has been less deep, there is a transitional layer, 2 to 5 inches thick, between the A and B horizons. In some places the C_{ca} horizon is absent.

The soils in this soil type will be eroded severely by wind if they are clean cultivated. In most cultivated fields, except in fields that have been deep plowed within the last 3 or 4 years, much of the silt and clay that was once in the uppermost 8 to 10 inches of the soil has been winnowed and blown away by wind. The undulating to hummocky topography in many areas has been caused by wind blowing the soil into mounds and low dunes many years ago. In cultivated fields that have slopes of about 4 percent or more, water erosion has caused some damage, mostly gullying.

Crops yield well on these soils, even in dry years. Average yields are higher than those made on other soils in the county. Careful and intensive management is needed to control wind erosion.

Miles loamy fine sand, undulating (Mk).--This soil occupies large areas in the northwestern part of the county. The topography consists of mounds and of intervening swales that are 2 to 5 feet lower than the tops of the mounds. The slopes between the high and low areas are dominantly 2 to 3 percent. In only a few places is the soil level.

Mapped with this soil are small concave areas of Altus loamy fine sands and knolls and ridges occupied by Springer loamy fine sands. In other areas that are mapped with this soil, the surface soil consists of dark grayish-brown loamy fine sand, 12 to 20 inches thick, that grades to a red subsoil. These included soils occupy 5 percent or less of any one area.

Cotton, sorghum for grain and fodder, wheat, oats, guar, summer and winter peas, and vetch grow well on this soil, and yields are high. Growing less cotton and a greater number of crops that yield large amounts of residue will help to protect the soil and to control wind erosion. Capability unit IIIe-6; range site, Sandy Land, Rolling Plains.

Miles loamy fine sand, hummocky, eroded (Mh2).--This soil occurs near areas of Miles loamy fine sand, undulating. In this soil wind has blown the soil materials into mounds or low dunes. The tops of the mounds are 5 to 12 feet higher than the intervening low places. The slopes between the high and low places are dominantly 4 to 6 percent.

Mapped with this soil are small, concave areas of Altus loamy fine sands and knolls and ridges occupied by Springer loamy fine sands. The included soils occupy less than about 15 percent of any one area.

Yields of crops are lower on Miles loamy fine sand, hummocky, eroded, than on Miles loamy fine sand, undulating. Capability unit IVe-5; range site, Sandy Land, Rolling Plains.

MILES FINE SANDY LOAM

In this soil type the soils have a reddish, loamy surface layer, 6 to 10 inches thick, that grades to

the more clayey subsoil. The upper part of the subsoil is reddish-brown, crumbly sandy clay loam, and the lower part is less friable, red sandy clay loam. Generally, there is a layer of caliche at a depth between 5 and 8 feet.

The following describes a profile near the north side of a nearly level, cultivated field (4.65 miles west of Haskell, 2.45 miles north of State Highway 24, and 300 feet east of farm road 2407):

A_{1p} 0 to 8 inches, reddish-brown (5YR 4/3) fine sandy loam, dark reddish brown (5YR 3/3) when moist; structureless; soft when dry, friable when moist, and nonsticky when wet; pH 7.0; abrupt boundary.

B_1 8 to 15 inches, reddish-brown (2.5YR 4/3) sandy clay loam, dark reddish brown (2.5YR 3/3) when moist; weak, coarse, prismatic structure; hard when dry, friable and crumbly when moist, and slightly sticky when wet; many fine pores; pH 6.7; gradual boundary.

B_2 15 to 39 inches, red (2.5YR 4/6), light sandy clay or sandy clay loam, dark red (2.5YR 3/6) when moist; compound moderate, medium, prismatic and moderate, coarse, subangular blocky structure; very hard when dry, firm when moist, and sticky when wet; many fine pores; pH 6.5; gradual boundary.

B_3 39 to 81 inches, red (2.5YR 5/6) sandy clay loam; weak, coarse, prismatic structure; hard when dry, firm when moist, and sticky when wet; many fine pores; few small concretions of calcium carbonate in the lower 12 to 15 inches; weakly calcareous; abrupt boundary.

C_{ca} 81 to 129 inches, pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) when moist; massive; consistence same as that in B_3 horizon; many soft lumps and hard concretions of calcium carbonate comprise about 20 percent, by volume, of the soil mass; the lumps and concretions are more concentrated in the uppermost 10 inches of this horizon than in the lower part; very strongly calcareous; diffuse boundary.

C 129 to 140 inches +, yellowish-red (5YR 5/6) sandy clay loam, (5YR 4/6) when moist; massive; same consistence as B_3 horizon; soft lumps of calcium carbonate occur, but gradually decrease in number with increasing depth; strongly calcareous.

The A_{1p} horizon ranges from reddish brown to brown in color and from 6 to 10 inches in thickness. In many places there is only a weak B_1 horizon. The B_2 horizon ranges from red to reddish brown in color and from heavy clay loam to light sandy clay loam in texture. Depth to the C_{ca} horizon is normally between 60 and 90 inches, but in some places it is about 45 inches.

Miles fine sandy loam, 0 to 1 percent slopes (MfA).--This soil absorbs water readily and holds it available for plants. The soil is subject to wind erosion, however, and requires protection from wind.

Mapped with this soil are small, level areas of Abilene loams and small knolls occupied by Springer and Miles loamy fine sands. Also included are small areas in which the uppermost 10 to 18 inches of the profile is dark grayish brown grading to reddish brown. These included soils do not occupy more than 2 percent of any one area.

Miles fine sandy loam, 0 to 1 percent slopes, is well suited to crops. All of the crops that are suited to the climate can be grown. The crops produce good yields even in dry years. Capability unit IIe-1; range site, Mixed Land, Rolling Plains.

Miles fine sandy loam, 1 to 3 percent slopes (MfB).--Except for slope, this soil is similar to Miles fine sandy loam, 0 to 1 percent slopes. Unless the soil is managed carefully, however, it will be eroded by water and wind (fig. 3).

Mapped with this soil are small knolls and ridges occupied by Springer and Miles loamy fine sands. The included soils do not occupy more than 1 percent of any one area.

Miles fine sandy loam, 1 to 3 percent slopes, is suited to the same crops as are grown on Miles fine sandy loam, 0 to 1 percent slopes. Capability unit IIe-1; range site, Mixed Land, Rolling Plains.

Miles fine sandy loam, 1 to 3 percent slopes, eroded (MfB2).--Except that this soil is eroded, it is similar to Miles fine sandy loam, 1 to 3 percent slopes. Most of the erosion was caused by water from runoff. The present surface soil is 3 to 6 inches thick. Gullies 1 to 2 feet deep and 100 to 200 feet apart have cut into the subsoil.

Fewer kinds of crops can be grown on this soil than on Miles fine sandy loam, 1 to 3 percent slopes. Also, because much of the surface soil is gone and the soil loses more water through runoff, yields are lower than on the less eroded soil. Capability unit IIIe-4; range site, Mixed Land, Rolling Plains.

Miles fine sandy loam, 3 to 5 percent slopes, eroded (MfC2).--This soil has been eroded by both water and wind. It should be used for small grains, sorghum grown in close rows, and grasses grown in sequence with small grains or sorghum. Capability unit IVe-3; range site, Mixed Land, Rolling Plains.

Miles fine sandy loam, 5 to 8 percent slopes, eroded (MfD2).--This soil is near the other Miles fine sandy loams, but it has stronger slopes than

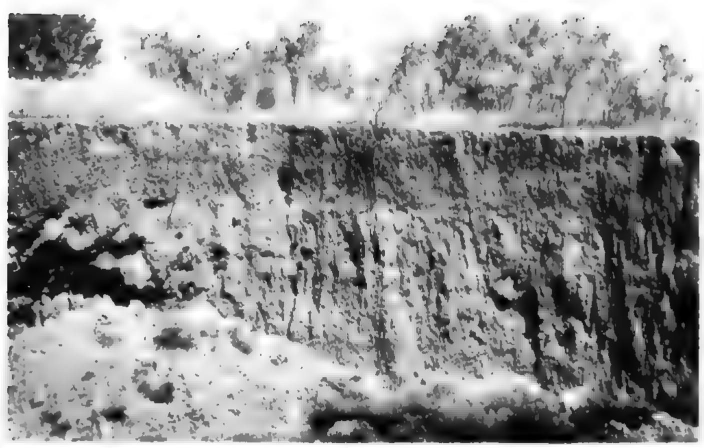

Figure 3.—Profile of Miles fine sandy loam, 1 to 3 percent slopes; the gully is about 30 feet deep.

those soils. Nearly all of the surface layer has been removed by water and wind. Gullies 15 to 30 inches deep and 100 to 200 feet apart have been caused by water from runoff.

Because of the hazard of erosion, this soil is not suited to crops. Capability unit VIe-1; Mixed Land, Rolling Plains.

Miles fine sandy loam, undulating (Md).--This soil occurs in large areas in the northwestern part of the county. Because there are many low mounds, the topography is irregular. The soil is likely to be eroded by water and wind.

Mapped with this soil are small, level areas of Abilene loams and small knolls and mounds occupied by Springer and Miles loamy fine sands. The included soils do not occupy more than about 2 percent of the total acreage.

All crops suited to the climate can be grown on Miles fine sandy loam, undulating. The crops make high yields. Capability unit IIe-1; range site, Mixed Land, Rolling Plains.

Miles fine sandy loam, undulating, eroded (Md2).--This soil occurs near areas of Miles fine sandy loam, undulating, and is of small extent. It has been eroded by water and wind. Furthermore, the wind has shifted the surface soil about to form a greater number of small mounds than are on the uneroded soil.

Mapped with this soil are areas of Abilene loams and Springer and Miles loamy fine sands. These included soils do not occupy more than about 2 percent of any one area.

Yields of crops are lower on Miles fine sandy loam, undulating, eroded, than on Miles fine sandy loam, undulating. Capability unit IIIe-4; range site, Mixed Land, Rolling Plains.

Miller Series

The Miller series consists of reddish, calcareous, alluvial soils. The soils formed in recent alluvium washed mostly from soils underlain by red beds. Short grasses, shrubs, and mesquite made up the native vegetation.

These soils occur near the Norwood and Yahola soils. Unlike those soils, the Miller soils have a subsoil of firm clay rather than one that is friable and loamy.

Two soil types of this series--Miller silty clay loam and Miller clay--are represented in this county.

MILLER SILTY CLAY LOAM

In this soil type are soils that have a reddish-brown, calcareous surface layer, 6 to 12 inches thick, underlain by dark reddish-brown, calcareous, very sticky clay. The lower part of the profile is reddish brown. It is generally lighter colored than the upper part of the profile.

The following describes a profile in a native pasture in the flood plain of Red Creek (10 miles east of Haskell and 1.8 miles south of State Highway 24):

A_1 0 to 8 inches, reddish-brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) when moist; compound moderate, medium, subangular blocky and coarse, granular structure; hard when dry, firm when moist, and sticky when wet; many fine roots; weakly calcareous; abrupt boundary.

AC 8 to 36 inches, dark reddish-brown (5YR 3/3) clay, (5YR 3/2) when moist; moderate, medium and coarse, irregular blocky structure; extremely hard when dry, very firm when moist, and very sticky and plastic when wet; few fine pores; roots moderately numerous in peds and in spaces between peds; strongly calcareous; gradual boundary.

C 36 to 72 inches +, reddish-brown (2.5YR 4/5) clay, dark reddish brown (2.5YR 3/5) when moist; weak, coarse, blocky structure; extremely hard when dry, very firm when moist, and very sticky and plastic when wet; strongly calcareous.

The A_1 horizon ranges from brown to reddish brown in color and from 6 to 12 inches in thickness. In the lower part of the AC and C horizons, the stratification is variable and weak in places.

The soils in this soil type are mostly in range. In many places the soils are flooded too frequently for crops to grow successfully. Furthermore, crops do not grow well on the areas that can be cultivated. This is probably because the soils have a low content of organic matter and contain much clayey material that is not well weathered.

Miller silty clay loam (Ms).--This soil is mostly in pasture. In some places near small creeks in the southwestern part of the county, the soil is dark brown to depths of 6 to 16 inches and grades to reddish-brown soil material. Mapped with Miller silty clay loam are small, low, concave areas of Miller clays and low ridges occupied by Miller silt loams and Norwood silty clay loams. These included soils do not occupy more than 15 percent of any one area. Miller silt loams are not mapped separately in the county.

Miller silty clay loam is well suited to grass, and many of the best forage grasses of the county grow on it. If it is not flooded too frequently, the soil can be used for crops, but it is only poorly suited to fairly well suited to such use. Adding organic matter will improve the soil for crops. Capability unit IIw-1; range site, Bottom Land, Rolling Plains.

MILLER CLAY

In this soil type the soils consist of reddish-brown, heavy, sticky clay that is strongly calcareous and is 3 to 4 feet thick. In some places there are thin strata of silty clay loam at depths below 2 feet.

The following describes a profile in the bottom lands of the Brazos River in a concave area in a cultivated field (4.7 miles west of Rule, 2.5 miles north of State Highway 24, and 0.6 mile east of a county road):

A 0 to 30 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) when moist; weak, medium to fine, subangular blocky structure; very hard when dry, very firm when

moist, and very sticky and plastic when wet; strongly calcareous; diffuse boundary.

AC 30 to 50 inches +, clay that has the same color and consistence as that in the A horizon; massive; few small, soft lumps of calcium carbonate.

The color of the A horizon ranges from brown to reddish brown. In some places there are strata of silt loam and silty clay loam in the AC horizon.

In this county Miller clay is chiefly in range, as it is mostly on large ranches where little of the acreage is cultivated.

Miller clay (Mr).--This soil has a surface layer of heavy clay, difficult to prepare as a good seedbed. Mapped with the soil are small ridges occupied by Miller silty clay loams and a few small, low areas in which the uppermost 12 to 14 inches of the soil is dark grayish-brown clay.

Miller clay is poor to fair for crops, but, if crops can be established, they make fair yields. Capability unit IIs-3; range site, Bottom Land, Rolling Plains.

Norwood Series

The Norwood series consists of reddish, calcareous, loamy soils. The soils have formed in alluvium and are on the flood plains of rivers and local streams. They are made up of a mixture of materials washed from red beds and from soils developed in outwash and in materials from the red beds. Short grasses and small mesquite trees were the native vegetation.

The Norwood soils occur near Miller and Yahola soils. These soils are all somewhat similar, but the Norwood soils have a subsoil of silty clay loam; the Miller soils, a subsoil of heavy, sticky clay; and the Yahola soils, a subsoil that is sandy.

Only one soil type of this series--Norwood silty clay loam--is represented in the county.

NORWOOD SILTY CLAY LOAM

In this soil type the soils have a surface layer of reddish-brown, friable and crumbly silty clay loam that is strongly calcareous. The surface layer is 8 to 20 inches thick and overlies a subsoil of yellowish-red, crumbly silty clay loam that is strongly calcareous.

The following describes a profile in a native pasture (5.2 miles east of Haskell on the north side of State Highway 24):

A_1 0 to 10 inches, reddish-brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 2/4) when moist; moderate, medium and fine, subangular blocky structure; very hard when dry, friable when moist, and slightly sticky when wet; many fine and medium pores; many fine roots; strongly calcareous; clear boundary.

AC 10 to 26 inches, yellowish-red (5YR 4/5) silty clay loam, (5YR 3/5) when moist; moderate, medium, subangular blocky structure; consistence same as that of A_1 horizon; many fine pores; many fine roots; strongly calcareous; diffuse boundary.

C 26 to 40 inches +, similar in color and consistence to the A_1 and AC horizons, but somewhat more sandy and friable; massive; strongly calcareous; few roots.

The A_1 horizon ranges from reddish brown to red in color and from 8 to 20 inches in thickness. Stratified layers of silt loam and clay commonly occur in the AC and C horizons.

The Norwood soils occur on flood plains in all but the northwestern part of the county. Most of the areas are on narrow flood plains that are crisscrossed by the channels of meandering streams. The soils are mainly in range. In some places they are flooded too frequently for crops to grow successfully.

Norwood silty clay loam (No).--This soil occurs on flood plains. Mapped with it are small areas of Miller silty clay loams, of Miller clays in narrow swales, and of Norwood silt loams on low ridges. The included soils do not occupy more than about 15 percent of any one area. Norwood silt loams are not mapped separately in this county.

If it is not flooded too frequently, Norwood silty clay loam is otherwise well suited to pasture and crops. Crops make good yields, but they produce better if organic matter is added. Capability unit IIw-1; range sites, Bottom Land, Rolling Plains; Bottom Land, Rolling Plains--Limestone.

Owens Series

The Owens series consists of dark, sticky, strongly calcareous clays. The soils developed under short grasses in light-colored, clayey materials and in materials derived from grayish shales in which there were thin strata of limestone and red shale.

The Owens soils occur near the Foard, Hollister, Stamford, and Tillman soils. Unlike the Owens soils, the Foard and Hollister soils have a surface layer of clay loam, and the Stamford and Tillman soils have a reddish color.

Only one soil type of this series--Owens clay--is represented in this county.

OWENS CLAY

In this soil type the soils consist of dark grayish-brown to brown, sticky, strongly calcareous clay that is 24 to 30 inches thick. The clay overlies olive-gray, weakly calcareous shale.

The following describes a profile in a native pasture, on a slope of about 1-1/2 percent (10 miles east of Haskell and 5 miles south of State Highway 24, south of a county road and 100 yards east of the corner of a road):

A_{11} 0 to 7 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; moderate to strong, fine and medium, subangular blocky structure in uppermost 2 inches and coarse, subangular blocky below; extremely hard when dry, very firm when moist, and very plastic and sticky when wet; few hard concretions of calcium carbonate; many fine roots; strongly calcareous; gradual boundary.

A_{12} 7 to 30 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; moderate, coarse, blocky structure; consistence same as that in the A_{11} horizon; many fine roots go through and between peds in upper part of the horizon, but there are few roots in the lower part; few large, soft lumps of calcium carbonate; strongly calcareous; gradual boundary.

C 30 to 48 inches +, olive-gray (5Y 4/5), shaly clay, dark olive gray (5Y 3/2) when moist; many, fine, distinct, brown mottles; massive; consistence similar to that of the A_{12} horizon; weakly calcareous.

The A_{11} horizon ranges from brown to dark grayish brown in color and from 5 to 14 inches in thickness. Depth to the C horizon ranges from 15 to 30 inches.

The soils in this soil type are in the southeastern part of the county where soils that have developed in red beds merge with soils developed over limestone. Nearly all the soils are in pasture on large ranches.

Owens clay, 1 to 3 percent slopes (OcB).--This soil is fairly well suited to range, but it is poorly suited to crops. A good seedbed is difficult to prepare because of the clayey texture of the surface layer. Capability unit IIIe-8; range site, Deep Hardlands, Rolling Plains.

Portales Series

The Portales series consists of moderately deep, brownish soils that are loamy and strongly calcareous. The soils developed in outwash materials under a cover of short grasses. They are probably calcified as the result of having a high water table, but later the water table was lowered. In many places the surface layer contains more sand than the surface layer in the typical profile. In these places the soil material in the uppermost 4 to 6 inches of the original profile was winnowed and much of it was blown away by wind.

The Portales soils occur near soils of the Abilene, Drake, Mansker, Miles, and Roscoe series. They are somewhat similar to these associated soils. The Portales soils, however, have a distinct C_{ca} horizon at a depth between 20 and 36 inches, and the Abilene and Roscoe soils have a C_{ca} horizon at a depth greater than 36 inches; the Drake soils lack a C_{ca} horizon; and the Mansker soils are shallow and have a C_{ca} horizon between about 10 and 24 inches. The Miles soils are deep, and they have a reddish color.

Two soil types of this series--Portales fine sandy loam and Portales clay loam--are represented in this county.

PORTALES FINE SANDY LOAM

In this soil type the surface layer of the soils is grayish-brown, friable, strongly calcareous fine sandy loam and is 5 to 10 inches thick. The subsoil is brown to dark grayish-brown, friable, strongly calcareous clay loam. A layer of caliche is at a depth between 20 and 36 inches.

The following describes a profile in a nearly level, cultivated field (8.7 miles west-southwest of O'Brien and 0.2 mile north of farm road 2229):

A_p 0 to 8 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; slightly hard when dry, friable when moist; many fine pores; strongly calcareous; clear boundary.

AC 8 to 26 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium and fine, subangular blocky structure; hard when dry, firm when moist, and sticky when wet; many medium and fine pores; many threads and films of calcium carbonate; very strongly calcareous; gradual boundary.

C_{ca} 26 to 62 inches +, light-gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) when moist; massive; hard when dry, friable when moist, and slightly sticky when wet; many coarse, soft lumps of calcium carbonate comprise about 30 percent, by volume, of the soil mass; very strongly calcareous.

The A_p horizon ranges from brown to dark grayish brown in color, from loam to light fine sandy loam in texture, and from 5 to 10 inches in thickness. The AC horizon ranges from dark grayish brown to grayish brown in color and from clay loam to sandy clay loam in texture. Depth to the C_{ca} horizon ranges from 20 to 36 inches but varies greatly within short distances.

The soils in this soil type are nearly all cultivated, and yields are moderate to high. The soils absorb water readily and lose little water through runoff. If sorghum is grown, the leaves turn yellow, especially when the plants are young or during dry spells. The yellowing is probably caused by the high content of lime in the soils.

Portales fine sandy loam, 0 to 1 percent slopes (PfA).--This soil is well suited to crops and is easy to till. If it is not protected during the blowing season, however, it will be damaged by wind erosion. Capability unit IIe-1; range site, Mixed Land, Rolling Plains.

PORTALES CLAY LOAM

In this soil type the soils have a surface layer of brown to grayish-brown, friable, calcareous clay loam that is 5 to 10 inches thick. The subsoil is grayish-brown, calcareous clay loam. A layer of caliche is at a depth between 20 and 36 inches.

The following describes a profile in a nearly level, cultivated field (1 mile northwest of O'Brien, 0.3 mile northwest of O'Brien cemetery, and 150 feet east of a county road):

A_{1p} 0 to 7 inches, brown (10YR 5/3), light clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; hard when dry, friable when moist, and slightly sticky when wet; the lower part of this horizon is compacted; weakly calcareous; clear boundary.

A_{12} 7 to 25 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; compound, moderate, coarse, prismatic and moderate, medium and fine, subangular blocky structure; very hard when dry, firm when moist, and sticky when wet; weakly calcareous; gradual boundary.

AC 25 to 30 inches, grayish-brown (10YR 5/2), heavy clay loam, dark grayish brown (10YR 4/2) when moist; structure and consistence similar to those of the A_{12} horizon; numerous threads and films of calcium carbonate; strongly calcareous; clear boundary.

C_{ca} 30 to 96 inches +, light-gray (10YR 6/1) clay loam, gray (10YR 5/1) when moist; the upper part of this horizon has moderate, medium, blocky structure, but the lower part is massive; consistence is similar to that of the AC horizon; many small, soft lumps of calcium carbonate, but the calcium carbonate is more concentrated in the upper 14 inches and in the lower 14 inches of the horizon; very strongly calcareous.

The A_{1p} horizon ranges from brown to grayish brown in color, from clay loam to sandy clay loam in texture, and from 5 to 10 inches in thickness. The texture of the A_{12} and AC horizons ranges from light clay to heavy clay loam. Depth to the C_{ca} horizon ranges from 20 to 36 inches.

Nearly all of the soils in this soil type are cultivated. They are suited to all of the crops commonly grown in the county, and yields are moderate to high.

Portales clay loam, 0 to 1 percent slopes (PcA).--This soil is easy to manage. It is nearly level, and little water is lost as the result of runoff. The hazard of wind erosion is slight if the soil is well managed. Capability unit IIc-1; range site, Deep Hardlands, Rolling Plains.

Randall Series

The Randall series is made up of deep, dark, heavy clays. The soils generally occur in the bottoms of the playas, or shallow, intermittent lakes. A few of the depressions in which the soils occur are filled with water for long periods during most years. In this county Randall clay formed from old outwash materials.

The Randall soils occur near the Abilene and Roscoe soils. Unlike the Randall soils, the Abilene and Roscoe soils occur in areas other than in distinct depressions.

Only one soil type of this series--Randall clay--is represented in this county.

RANDALL CLAY

In this soil type the surface layer of the soils is very dark gray, heavy, calcareous clay that is 4 to 8 inches thick. The subsoil is dark gray, heavy textured, and noncalcareous.

The following describes a profile in a shallow playa (on the northwestern side of Haskell, 0.2 mile north of farm road 2163):

A_p 0 to 6 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; weak, fine, blocky structure; extremely hard when dry, very firm when moist, and very plastic and sticky when wet; noncalcareous; gradual boundary.

AC 6 to 60 inches +, gray (10YR 5/1) clay, upper part of horizon dark gray (10YR 4/1) when moist, but soil material in lower part of horizon grades to light gray when moist; weak, coarse, blocky structure; consistence similar to that of A_p horizon; few fine pores in upper part of this horizon; noncalcareous.

The A_p horizon ranges from very dark gray to dark gray in color and from 4 to 8 inches in thickness. In some places the surface layer is clay loam or sandy clay loam and is 3 to 4 inches thick as the result of soil material having been washed or blown into the depressions.

In Haskell County most of the acreage in this soil type is cultivated, but a few places are too wet for cultivation. Nearly all of the areas receive runoff water.

Randall clay (Ra).--This soil is fairly well suited to crops if it is protected from runoff from higher areas. A good seedbed is difficult to prepare, however, because of the clayey texture of the soil. Capability unit IIIw-1; range site, Deep Hardlands, Rolling Plains.

Roscoe Series

The Roscoe series consists of deep, dark-colored, clayey soils that are calcareous. The soils formed in a thick mantle of outwash materials that were deposited over the red beds. Short grasses were the native vegetation.

These soils are nearly level. They lack a textural profile, and their texture is clay throughout. The soils occur near the Abilene, Foard, Hollister, and Randall soils. They differ from these associated soils in that the Abilene soils have a surface layer of clay loam or lighter texture and a textural profile; the Foard and Hollister soils, which developed in material from the red beds, have surface layers of clay loam and textural profiles; and the Randall soils occur in playas or in the beds of shallow lakes.

Only one soil type of this series--Roscoe clay--is represented in this county.

ROSCOE CLAY

In this soil type the surface layer of the soils is dark grayish-brown, calcareous, sticky clay. The subsoil is heavy, sticky, calcareous clay. The upper part of the subsoil is very dark gray, and the lower part is grayish brown. Soft lumps of lime occur at a depth between 38 and 50 inches.

The following describes a profile in a nearly level, cultivated field (10 miles north of Haskell and 0.9 mile east of farm road 2163):

A_{1p} 0 to 5 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; very hard when dry, very firm when moist, and very sticky when wet; many fine roots; weakly calcareous; abrupt boundary.

A_{12} 5 to 15 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; moderate, medium and fine, subangular blocky structure; consistence similar to that of the A_{1p} horizon; few fine roots through and between peds; weakly calcareous; clear, wavy boundary.

A_{13} 15 to 42 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; moderate, medium and coarse, irregular blocky structure; extremely hard when dry, extremely firm when moist, and very sticky and plastic when wet; weakly calcareous; few small, soft concretions of calcium carbonate; gradual, wavy boundary.

AC 42 to 54 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; weak, coarse, irregular blocky structure; very hard when dry, very firm when moist, and very sticky and plastic when wet; strongly calcareous; many small, soft lumps of calcium carbonate and clusters of gypsum crystals; diffuse boundary.

C_{ca} 54 to 96 inches, mottled light-gray and pink clay; massive; consistence similar to that of the AC horizon; many coarse, soft lumps of calcium carbonate comprise about 30 percent, by volume, of the soil mass; numerous clusters of gypsum crystals; very strongly calcareous; gradual boundary.

C 96 to 110 inches +, reddish-yellow (5YR 6/6) clay, yellowish red (5YR 5/6) when moist, with streaks of light gray; massive; consistence similar to that of the C_{ca} horizon; weakly calcareous.

The A_{1p} horizon ranges from very dark gray to dark grayish brown in color. The combined thickness of the A_{1p} and A_{12} horizons ranges from 14 to 24 inches. Depth to the C_{ca} horizons ranges from 45 to 60 inches. In some places the soils occur in small, slightly concave areas and have a darker, more grayish color than normal. The soils in some places have a distinctly spotted appearance, the result of a gilgai condition when they were under native vegetation.

About 90 percent of the total acreage of these soils is cultivated. The soils have a good supply of organic matter, but they absorb water slowly. These soils are productive, but yields are often low during periods of extended dry weather.

Roscoe clay, 0 to 1 percent slopes (RcA).--This soil is easy to manage. Little water is lost through runoff, and there is only a slight risk of erosion by either wind or water. In some places the surface layer is clay loam to a depth of 2 to 3 inches.

Mapped with this soil are small areas of Abilene clay loams. These included soils occupy less than 1 percent of any one area.

All crops suited to the climate can be grown on Roscoe clay, 0 to 1 percent slopes. In many years, however, grain sorghum does not grow well because the weather is dry during the growing season. Capability unit IIs-1; range site, Deep Hardlands, Rolling Plains.

Roscoe clay, 1 to 3 percent slopes (RcB).--This soil occurs near large areas of Roscoe clay, 0 to 1 percent slopes. It is in areas that lead to drainageways. The soil is gently sloping, and the slopes are dominantly 1-1/2 percent. Areas that have been cultivated are slightly eroded and have rills and other evidence of washing.

This soil is productive. Water is lost through runoff. The soil needs careful management to reduce runoff and to protect it from water erosion. Capability unit IIe-4; range site, Deep Hardlands, Rolling Plains.

Rough Broken Lands

These miscellaneous land types are made up of sandy or clayey materials. The sandy materials were derived from outwash, and the clayey materials, from red beds.

Rough broken land, sandy (Rs).--This miscellaneous land type consists of exposed, reddish, strongly calcareous sandy clay loam from outwash. The areas are mainly west and northwest of Rule. They occur at the place where the nearly level plain breaks to the valley of the Double Mountain Fork of the Brazos River, which has cut through the outwash. The topography is rough, and the areas are severely eroded. Slopes are dominantly 12 to 20 percent, but they are more than 50 percent in many places. The soil material on the faces of the steep, exposed slopes is not stabilized. Gullying and sheet erosion are severe; the soil materials on the faces of the slopes are washed away before a soil profile has time to develop.

This land type has little value for agriculture. The vegetation consists of scrubby cedar and a thin stand of grasses. It is not sufficient to protect the land from further erosion. Capability unit VIIe-1; range site, Rough Breaks, Rolling Plains.

Rough broken land, clayey (Ro).--This miscellaneous land type consists of exposed, unweathered material of the red beds. The material is made up mainly of reddish, calcareous clays and shales, but it includes thin strata of blue shale. It occurs in areas where the nearly level plain, overlying the red beds, has been broken by valleys that were cut by streams. The soil materials on the slopes, between the higher, smooth plain and the flood plains of the streams, have not become stabilized. Gullies are still cutting into the plain, and many short gullies branch out on each side of the main gullies. The resulting topography is rough. Slopes are dominantly 12 to 20 percent, but in places they are as much as 50 percent or more.

This land type occurs in most parts of the county. It has little value for agriculture. The cover of vegetation is sparse and of little use in helping to reduce erosion. Capability unit VIIe-1; range site, Rough Breaks, Rolling Plains.

Sandy Alluvial Fans

Sandy alluvial fans are on foot slopes. They consist of sandy local alluvium washed from areas of Rough broken land, sandy, that lie just above. The material, to a depth of 3 to 5 feet, is reddish, strongly calcareous fine sandy loam, loamy sand, or stratified fine sand. Some rounded, waterworn gravel

is on the surface and is mixed with the soil material. Slopes range from 1 to 5 percent, but they are dominantly 1 to 3 percent.

Sandy alluvial fans (Sa).--This miscellaneous land type has a severe hazard of erosion from wind and water. Runoff flows rapidly over the land from adjacent higher areas of Rough broken land and causes gully and sheet erosion; fresh deposits of sandy material are also laid down.

Most of this land type is in range. It can be cultivated but requires protection from runoff and wind to prevent erosion. Capability unit IVe-4; range site, Bottom Land, Rolling Plains.

Springer Series

The Springer series is made up of brownish, noncalcareous, loose, sandy soils. The soils occupy stabilized, low dunes that were formed by wind. The native vegetation consisted of coarse bunch grasses.

These soils occur near the Abilene, Enterprise, and Miles soils. They have a weakly developed subsoil of reddish fine sandy loam. In contrast, the Abilene soils, have a subsoil of dark grayish-brown clay; the Enterprise soils have no textural profile and are more sandy in the lower part than the Springer soils; and the Miles soils have a subsoil of sandy clay loam to light sandy clay.

Only one soil type of this series--Springer loamy fine sand--is represented in this county.

SPRINGER LOAMY FINE SAND

In this soil type the surface layer of the soils is brownish, noncalcareous loamy fine sand. The upper part of the subsoil is reddish-brown, noncalcareous, heavy fine sandy loam, and the lower part is fine sandy loam. Depth to clay loam or light sandy clay is 46 to 70 inches.

The following describes a profile near the edge of an undulating, cultivated field (0.4 mile west of O'Brien, northeast of a curve in farm road 2229):

A_p 0 to 14 inches, brown (7.5YR 4/3) loamy fine sand, dark brown (7.5YR 3/3) when moist; structureless; soft when dry, very friable when moist, and nonsticky when wet; pH 7.0; abrupt boundary.

B_2 14 to 20 inches, reddish-brown (5YR 4/4), heavy fine sandy loam or loam, dark reddish brown (5YR 3/4) when moist; massive; very hard when dry, friable when moist, and slightly sticky when wet; many fine pores; pH 6.5; gradual boundary.

B_3 20 to 58 inches, yellowish-red (5YR 4/6) fine sandy loam, (5YR 3/6) when moist; massive; consistence similar to that of B_2 horizon; many fine pores; pH 6.7; clear boundary.

B_{3b} 58 to 75 inches +, red (2.5YR 4/6), heavy sandy clay loam, dark red (2.5YR 3/6) when moist; moderate, medium, subangular blocky structure; very hard when dry, friable when moist, and sticky when wet; pH 7.0.

The A_p horizon ranges from 10 to 20 inches in thickness. In some places there is a weak B_2 horizon of fine sandy loam. The B_2 horizon ranges from red to brown in color, from fine sandy loam to sandy clay loam in texture, and from 5 to 12 inches in thickness.

The soils in this soil type absorb water readily, but some of the water drains through the profile and is lost. These soils will be severely eroded by wind if they are clean cultivated. In all of the cultivated areas, much of the silt and clay in the uppermost 8 to 12 inches of the soil has been winnowed and blown away by wind. If careful management is used to prevent wind erosion, crops make high yields on these soils.

Springer loamy fine sand, undulating (Sk).--In this soil low, stabilized dunes cause the topography to be irregular. Mapped with the soil are small, low areas of Altus loamy fine sands and small areas of Miles loamy fine sands. In areas where the Altus soils occupy more than 15 percent of an area and are intricately mixed with the Springer soils, the soils of the two series are mapped in a complex as Springer-Altus loamy fine sands.

Crops on Springer loamy fine sand, undulating, make good yields. Water collects and stands in low places between the dunes for short periods after heavy rains, but damage to crops is slight. Capability unit IVe-5; range site, Sandy Land, Rolling Plains.

Springer loamy fine sand, hummocky (Sh).--This soil occurs near areas of Springer loamy fine sand, undulating. The two soils are similar, but this soil has rougher topography. The dunes are higher, and the sides of the dunes have steeper slopes. The soil is susceptible to severe wind erosion.

This soil is not suited to crops. If the soil is cultivated, wind will cause severe damage and will also cause blowouts. Capability unit VIe-2; range site, Sandy Land, Rolling Plains.

Springer-Altus loamy fine sands (Sm).--This complex is made up mainly of areas of Springer and Altus soils that are too intricately mixed to map separately. The Springer soils are on low dunes or ridges, and the Altus soils occupy the level areas between. From 15 to 30 percent of an area consists of Altus soils, 5 percent or less is Miles loamy fine sands, and the rest of the complex is made up of Springer soils.

Crops produce good yields on these soils, but careful management is needed to reduce wind erosion. During heavy rains, water collects and stands for short periods on the Altus soils. The water does not damage crops, however, and it often helps to increase yields. Capability unit IIIe-6; range site, Sandy Land, Rolling Plains.

Spur Series

The Spur series consists of brownish, noncalcareous loamy soils that are on the flood plains of Lake Creek. The soils formed in alluvial materials washed from Abilene, Roscoe, and Miles soils. Mesquite and short grasses were the native vegetation.

The Spur soils are similar to the Norwood soils, but they are brownish and noncalcareous rather than reddish and strongly calcareous. The texture

of the surface layer varies within short distances in the Spur soils and the underlying material is also variable. Consequently, a representative profile is not given for this series.

Spur soils (Sr).--In these soils the surface layer ranges from brown to grayish brown in color, from very fine sandy loam to loam in texture, and from 9 to 18 inches in thickness. Below this is sandy clay loam to clay loam that is stratified in many places. Depth to calcareous material ranges from 18 to 38 inches.

Nearly one-half of the total acreage of these soils is cultivated. Cultivation is mostly along the outer boundaries of the higher lying areas. The higher lying areas are flooded occasionally, but they generally can be used for crops. Capability unit IVw-1; range site, Bottom Land, Rolling Plains.

Stamford Series

The Stamford series consists of moderately deep, reddish, sticky clays that are calcareous. The soils developed under a cover of short grasses from materials of the Permian red beds.

The soils are near the Foard, Hollister, Tillman, and Vernon soils. They differ from these associated soils in that the Foard and Hollister soils are brown to dark brown and are clay loams; the Tillman soils are reddish clay loams; and the Vernon soils are shallow, reddish clays.

Only one soil type of this series--Stamford clay--is represented in this county.

STAMFORD CLAY

In this soil type the soils consist of reddish-brown, calcareous, heavy, sticky clay that is 2 to 3 feet thick. The clay is a little more crumbly in the uppermost few inches than in the lower part of the profile. At a depth below 2 or 3 feet, the sticky clay grades to a mixture of clay and shale from the red beds.

The following describes a profile in a native pasture with a slope of about 2 percent (9.3 miles east of Haskell and 0.9 mile north of State Highway 24 on the west side of a county road):

A_{11} 0 to 5 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; moderate, fine, angular blocky structure; extremely hard when dry, very firm when moist, and extremely sticky and plastic when wet; few roots; numerous rocklike fragments of blue shale on the surface; strongly calcareous; gradual boundary.

A_{12} 5 to 14 inches, clay that is the same color as that in the A_{11} horizon; moderate, coarse, blocky structure that breaks to fine, angular, blocky structure; consistence is same as that of the A_{11} horizon; few soft, indistinct lumps of calcium carbonate; very few roots; strongly calcareous; gradual boundary.

AC 14 to 34 inches, dark reddish-brown (2.5YR 3/4) clay, color the same when the soil is moist; moderate, coarse and very coarse, blocky structure; consistence is same as that of the A_{11} horizon; few soft, indistinct spots of calcium carbonate; strongly calcareous; diffuse boundary.

C 34 to 48 inches+, dark reddish-brown (2.5YR 3/4) clay, (2.5YR 2/4) when moist; massive; fine specks of blue shale; this horizon is parent material derived from the red beds.

The A_{11} horizon ranges from reddish brown to dark reddish brown in color and from 4 to 10 inches in thickness. Depth to the AC horizon ranges from 12 to 20 inches, and depth to the C horizon ranges from 26 to 40 inches.

About one-third of the acreage in this soil type is cultivated. The soils are not suited to crops and are only moderately well suited to range. The heavy clay is hard to work to a good seedbed. In addition, the soils absorb water very slowly and are droughty. In cultivated fields, where slopes are greater than about 1 percent, the soils are slightly eroded and have rills and other evidence of washing.

Stamford clay, 1 to 3 percent slopes (StB).--This soil is likely to be eroded by wind and water. Mapped with it are small areas of shallow Tillman clay loams and Vernon clays. The included soils do not occupy more than 3 percent of any one area.

Stamford clay, 1 to 3 percent slopes, is poorly suited to crops, but it is better suited to small grains than to most other crops. Careful management is needed to control erosion and to reduce loss of water by runoff. Capability unit IIIe-8; range site, Deep Hardlands, Rolling Plains.

Stamford clay, 3 to 5 percent slopes (StC).--This soil occurs near Stamford clay, 1 to 3 percent slopes. It is more sloping than that soil and has a greater hazard of water erosion. Mapped with it are small areas of shallow Tillman clay loams and Vernon clays. These included soils do not occupy more than 5 percent of any one area.

Stamford clay, 3 to 5 percent slopes, is poorly suited to cultivated crops and is best kept in grass. Capability unit IVe-1; range site, Deep Hardlands, Rolling Plains.

Stamford clay, 3 to 5 percent slopes, eroded (StC2).--This soil occurs near the other Stamford clays. More of it has been cultivated, however, and a larger acreage has been damaged by sheet erosion and gullying. Mapped with this soil are small areas of shallow Tillman clay loams and Vernon clays. The areas of included soils are larger than those mapped with other Stamford clays, but they do not occupy more than 15 percent of any one area.

Small grains can be grown on Stamford clay, 3 to 5 percent slopes, eroded, if the soil is well managed. Capability unit IVe-1; range site, Deep Hardlands, Rolling Plains.

Tarrant Series

The Tarrant series is made up of dark-colored, clayey soils that are strongly calcareous. The soils form a thin mantle over limestone bedrock and have many boulders and fragments of limestone on the surface. In many places there is little true soil. Shrubs and mid grasses were the native vegetation.

These soils occur near the Byrds and Valera soils. They are shallower over limestone bedrock

than the soils of either the Byrds or Valera series.

Only one soil type of this series--Tarrant stony clay--is represented in the county.

TARRANT STONY CLAY

In this soil type the soils consist of very dark gray, calcareous, crumbly clay. The clay is 2 to 6 inches thick and rests on limestone bedrock.

The following describes a profile in a native pasture with a slope of 5 percent (on the Raughton Ranch next to a county road that runs east to west):

A 0 to 4 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; strong, fine, subangular blocky and granular structure; very hard when dry, friable when moist, and sticky when wet; strongly calcareous; numerous limestone fragments, as large as 18 inches in diameter, are on the surface or outcrop and occupy about 50 percent of the total surface area; abrupt, broken boundary.

Dr 4 inches+, broken limestone.

Tarrant stony clay, 0 to 8 percent slopes (TaD).--This soil occupies large areas in the southeastern corner of the county. It is on ridges and in the less sloping areas around drainageways. Mapped with this soil are small areas of shallow Valera clays that are on the benches or bottoms of small streams, and small areas of deeper Valera clays.

All of Tarrant stony clay, 0 to 8 percent slopes, is in range. The forage produced is nutritious (fig. 4). Capability unit VIs-1; range site, Shallow land, Rolling Plains-Limestone.

Tarrant stony clay, 8 to 20 percent slopes (TaF).--This soil occurs near Tarrant stony clay, 0 to 8 percent slopes. It ranges from strongly sloping to steep, but the slopes are dominantly 8 to 20 percent. Mapped with the soil are small areas that have clifflike slopes.

Tarrant stony clay, 8 to 20 percent slopes, has a surface layer that contains little true soil, but crevices in the stony clay are filled with gray, strongly calcareous material. Shrubs and nutritious grasses grow in the crevices. Capability unit VIIs-1, Rocky Hills, Rolling Plains-Limestone.

Figure 4.—Tarrant stony clay, 0 to 8 percent slopes; this soil contains stones, but nutritious grass grows on it.

Tillman Series

The Tillman series consists of deep, noncalcareous soils that have a subsoil of heavy clay resembling a pan. The soils developed under a cover of short grasses from materials of the Permian red beds. The gently sloping to sloping areas are slightly eroded and have rills and other evidence of washing.

The Tillman soils have a surface soil of clay loam and a subsoil of reddish clay. They occur near the Foard, Hollister, Stamford, and Vernon soils. Unlike the Tillman soils, the Foard and Hollister soils have surface layers of brown to dark-brown clay loam and their subsoils are dark brown to dark grayish brown. The Stamford and Vernon soils are similar in color to the Tillman soils, but they have surface soils of heavy clay.

TILLMAN CLAY LOAM

The soils in this soil type have a surface soil of sticky clay loam and a subsoil of heavy, sticky clay. They have a reddish-brown color and are noncalcareous. At a depth between 30 and 48 inches, a weak layer of lime has accumulated.

The following describes a profile in native range where slopes are about 1 percent (10.8 miles southeast of Haskell on the eastern side of the Buford Cox Farm, 100 yards west of a county road, and 100 feet south of a field fence):

A_1 0 to 6 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) when moist; weak, fine, subangular blocky structure; very hard when dry, firm when moist, and sticky when wet; many fine pores; many fine roots; few wormholes; noncalcareous; clear boundary.

B_2 6 to 22 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) when moist; moderate, medium, angular blocky structure; extremely hard when dry, very firm when moist, and very sticky and plastic when wet; few very fine pores; many fine roots, mostly between the peds, but some through the peds; weakly calcareous; gradual boundary.

B_3 22 to 42 inches, reddish-brown (2.5YR 4/5) clay, dark reddish brown (2.5YR 3/5) when moist; weak, coarse, blocky structure; consistence same as that of the B_2 horizon; many small, soft lumps and hard concretions of calcium carbonate; many wormcasts; few fine roots; threads of calcium sulfate in old root channels in the lower part of this horizon; strongly calcareous; clear boundary.

C_{ca} 42 to 58 inches, weak-red (10R 4/4) clay, dusky red (10R 3/4) when moist; massive; consistence same as that of the B_2 horizon; very strongly calcareous; soft lumps of calcium carbonate, 1/2 to 3 inches in diameter, occupy about 30 percent, by volume, of the soil mass; diffuse boundary.

C 58 to 70 inches+, red (10R 4/5) clay from Permian red beds, dark red (10R 3/5) when moist; massive; consistence same as that of the B_2 horizon; few coarse, soft lumps of calcium carbonate.

The A_1 horizon ranges from brown to reddish brown in color and from 4 to 7 inches in thickness; in places it is calcareous. In many places there is a thin B_1 horizon, or transitional layer, of subangular blocky, light clay. The B_2 horizon ranges in structure from moderate to strong blocky or angular blocky. Depth to the C_{ca} horizon ranges from 30 to 48 inches. In many places the C_{ca} horizon is indistinct.

In the eastern part of the county, the red-bed parent material is more silty than in other parts of the county. Here, the soils are a little more crumbly than the soil material in the profile described, especially in the upper part of the subsoil.

The soils in this soil type absorb water very slowly and are droughty. They are best suited to small grains and other crops that grow in cool seasons. Other crops can be grown, however, and a large acreage is planted to cotton and sorghum. About one-half of the acreage of these soils is cultivated.

Tillman clay loam, 0 to 1 percent slopes (TcA).--This nearly level soil is less droughty than the more sloping Tillman clay loams. In most places simple management practices can be used to reduce losses of water through runoff. In some places the soil has dark spots probably caused by a gilgai condition when the soil was covered by the original native grasses. The dark spots are particularly noticeable when the soil has been freshly plowed. Capability unit IIs-2; range site, Deep Hardlands, Rolling Plains.

Tillman clay loam, 1 to 3 percent slopes (TcB).--This soil occurs near areas of Tillman clay loam, 0 to 1 percent slopes, but it has stronger slopes than that soil and absorbs water very slowly. Consequently, more water is lost through runoff. Mapped with this soil are small areas of shallow Tillman clay loams. These included soils occupy less than 2 percent of any one area.

Tillman clay loam, 1 to 3 percent slopes, requires careful management to prevent erosion through runoff. Capability unit IIIe-1; range site, Deep Hardlands, Rolling Plains.

Tillman clay loam, 1 to 3 percent slopes, eroded (TcB2).--Except that runoff has caused gullying and sheet erosion in this soil, it is similar to Tillman clay loam, 1 to 3 percent slopes, and occurs near that soil.

Mapped with this soil are areas of shallow Tillman clay loams. These included soils do not occupy more than 5 percent of any one area. Capability unit IIIe-1; range site, Deep Hardlands, Rolling Plains.

Tillman clay loam, 3 to 5 percent slopes (TcC).--Most of this soil is in range to which it is best suited. If the soil is managed intensively, small grains can be grown. Capability unit IVe-1; range site, Deep Hardlands, Rolling Plains.

TILLMAN CLAY LOAM, SHALLOW

Except for having the C_{ca} horizon at a shallower depth, the shallow Tillman clay loams are similar to the Tillman clay loams. The soils consist of reddish-brown, alkaline to calcareous clay loam that overlies reddish-brown, calcareous, sticky clay. The cultivated areas that have slopes of more than 1 percent are slightly eroded and have rills and other evidence of washing.

The following describes a profile along the edge of a gently sloping, cultivated field (4.8 miles east of Haskell on the south side of State Highway 24):

A_{1p} 0 to 5 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) when moist; weak, fine and very fine, subangular blocky structure; hard when dry, firm when moist, and sticky when wet; noncalcareous in most places, but weakly calcareous in places; abrupt boundary.

B_2 5 to 17 inches, clay the same color as that in the A_{1p} horizon; mainly strong to moderate, medium, blocky structure, but subangular blocky in places in the uppermost 3 inches; very hard when dry, very firm when moist, and very sticky and plastic when wet; weakly calcareous; few small concretions of calcium carbonate in the lower part of the horizon; gradual boundary.

C_{ca} 17 to 26 inches, yellowish-red (5YR 4/5) clay, (5YR 4/6) when moist; structure and consistence similar to that of B_2 horizon; many soft lumps of calcium carbonate, 1/4 to 1/2 inch in diameter, comprise about 10 percent, by volume, of the soil mass; strongly calcareous; diffuse boundary.

C 26 to 40 inches +, red (2.5YR 4/6) clay from partially weathered red beds, dark red when moist; a few soft lumps of calcium carbonate in the upper part of this horizon.

The A_{1p} horizon ranges from brown to reddish brown in color and from 4 to 7 inches in thickness. The B_2 horizon in some places is heavy, crumbly clay loam. Depth to the C_{ca} horizon ranges from 10 to 24 inches.

The soils in this soil type are poorly suited to crops but are fairly well suited to range. Because the C_{ca} horizon is at a shallow depth, the development of roots is limited in the soils, and the soils are limited in water-holding capacity. They are better suited to crops that grow best in cool seasons than to other crops. Less than one-half of the acreage is cultivated.

Tillman clay loam, shallow, 0 to 3 percent slopes (TmB).--This soil is on ridges, at the crests of slopes occupied by Tillman clay loams, and on gentle slopes that lead to drainageways. Mapped with the soil are small areas of Tillman clay loams and of soils of the Vernon series. The included soils do not occupy more than 2 percent of any one area.

Tillman clay loam, shallow, 0 to 3 percent slopes, is moderately susceptible to water erosion if it is cultivated. Capability unit IIIe-3; range site, Shallow Hardlands, Rolling Plains.

Tillman clay loam, shallow, 3 to 5 percent slopes (TmC).--This soil occurs in areas that lead to drainageways. It is near areas of Tillman clay loam, shallow, 0 to 3 percent slopes. The two soils are similar, but this soil has stronger slopes. Consequently, it is more likely to be eroded by water.

Mapped with this soil are small areas of Vernon soils. The included soils do not occupy more than 5 percent of any one area.

If cultivated, Tillman clay loam, shallow, 3 to 5 percent slopes, requires intensive management to protect it from water erosion. Capability unit IVe-2; range site, Shallow Hardlands, Rolling Plains.

Tillman clay loam, shallow, 1 to 5 percent slopes, eroded (TmC2).--This soil is similar to Tillman clay loam, shallow, 0 to 3 percent slopes, except that it has been damaged by runoff, which has caused gullying and sheet erosion. Mapped with it are small areas of Vernon soils. The included soils do not occupy more than 15 percent of any one area.

Tillman clay loam, shallow, 1 to 5 percent slopes, eroded, is better suited to range than to crops, but small grains can be grown. If cultivated, the soil requires intensive management to protect it from further erosion. Capability unit IVe-2; range site, Shallow Hardlands, Rolling Plains.

Tillman-Foard complex, 0 to 1 percent slopes (TrA).--This complex is made up of areas of Tillman and Foard soils that are too small and intermixed to map separately. The soils have profiles similar to those described for the Tillman and Foard series. The Tillman soils are on microknolls or ridges surrounding microdepressions occupied by Foard soils. The microdepressions are circular and range from 8 to 15 feet in diameter; they are 4 to 12 inches lower than the tops of the microknolls. In some places the soils in the depressions are clayey throughout or have a surface layer of clay loam that is 1 to 3 inches thick. The areas of this complex are the result of gilgai action. If plowed, they have a distinctly spotted appearance.

The soils in this complex are nearly level and lose little water through runoff. They absorb water very slowly and are droughty. The complex is only fairly well suited to crops. Only about one-half of the acreage is cultivated. Capability unit IIs-2; range site, Deep Hardlands, Rolling Plains.

Tipton Series

The Tipton series consists of deep, brownish, alkaline, loamy soils on stream terraces. The soils developed in old alluvium under a cover of mid and short grasses. Their textural profile is weakly developed.

These soils occur near or are similar to the Enterprise, Miller, and Norwood soils. The Enterprise soils do not have a textural profile. The Miller and Norwood soils do not have a textural profile but are stratified in places. They are on flood plains.

Only one soil type of this series--Tipton loam--is represented in the county.

TIPTON LOAM

The surface layer of the soils in this soil type is brown, noncalcareous loam. The subsoil is friable, alkaline sandy clay loam. The upper part of the subsoil is dark brown, and the lower part is reddish brown.

The following describes a profile in a nearly level, cultivated field (9 miles west-southwest of O'Brien on farm road 2229 and 1.5 miles north of the intersection of that road with farm road 2279, on the east side of road 2279):

A_{1p} 0 to 10 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 3/4) when moist; weak, granular structure; soft when dry, friable when moist, and slightly sticky when wet; noncalcareous; clear boundary.

A_{12} 10 to 16 inches, dark-brown (7.5YR 4/2), heavy loam, (7.5YR 3/2) when moist; weak, coarse, prismatic and granular structure; slightly hard when dry, friable when moist, and slightly sticky when wet; many medium and fine pores; noncalcareous; gradual boundary.

B_2 16 to 44 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, and slightly sticky when wet; many fine pores; noncalcareous; gradual boundary.

C 44 to 60 inches +, yellowish-red (5YR 4/6) sandy clay loam, same color when moist; massive; hard when dry, but friable when moist; calcareous.

The A_{1p} horizon ranges from brown to dark brown in color, from loam to very fine sandy loam in texture, and from 10 to 20 inches in thickness. In places the soil is calcareous throughout. The B_2 horizon ranges from reddish brown to brown in color and from sandy clay loam to light clay loam in texture.

These soils are productive. They absorb water readily and retain it well. Crops produce good yields on them, even in dry years. Capability unit I-1; range site, Mixed land, Rolling Plains.

Tipton loam, 0 to 1 percent slopes (TtA).--Most of this soil is in the northwestern part of the county. It loses little water through runoff, and there is no risk of erosion by water. If it is not protected, however, it will be eroded by wind. Capability unit I-1; range site, Mixed Land, Rolling Plains.

Valera Series

The Valera series consists of moderately deep, dark-colored clays that are calcareous and crumbly. The soils are underlain by limestone. They developed under a dense cover of short grasses.

The Valera soils occur near the Byrds and Tarrant soils. They are browner than the Byrds soils and deeper over bedrock than the Tarrant soils.

VALERA CLAY

In this soil type the soils consist of dark-brown to dark grayish-brown, calcareous clay that is 26 to about 44 inches thick and overlies broken limestone. The uppermost few inches is brown and very crumbly, but, with increasing depth, the soil material becomes less crumbly and has a more blocky structure.

The following describes a profile in a nearly level pasture (along a north-south county road in the southeastern corner of the Brooks Early Ranch):

A_{11} 0 to 7 inches, dark-brown (7.5YR 4/2) clay, (7.5YR 3/2) when moist; strong, fine, subangular blocky structure; very hard when dry,

very firm when moist, and very sticky when wet; many fine pores; many fine roots; weakly calcareous; gradual boundary.

A_{12} 7 to 20 inches, dark-brown (7.5YR 4/3) clay, dark brown (7.5YR 3/3) when moist; moderate, medium, subangular blocky structure, extremely hard when dry, very firm when moist, and very sticky when wet; strongly calcareous; many fine pores; many fine roots; diffuse boundary.

A_{13} 20 to 32 inches of clay the same color as that in the A_{12} horizon; compound, moderate, medium, subangular blocky and blocky structure in upper part and moderate, medium, blocky structure in the lower part; few to numerous, small, hard concretions of calcium carbonate in the lower part; few fine roots; strongly calcareous; abrupt boundary.

Dr 32 inches +, broken limestone.

The color ranges from brown to dark grayish brown. In places there is a distinct C_{ca} horizon just above the limestone bedrock. Depth to the limestone ranges from 20 to 44 inches. In places where bedrock is at a depth of less than 24 inches, the lower part of the profile does not have a blocky structure.

Most of the soils in this soil type are in large ranches and are pastured. The soils are well suited to field crops and grasses. The grasses are nutritious. The soils absorb water slowly and retain it well. Consequently, crops can be grown, even in dry years. In some places, however, the limestone bedrock limits the depth to which roots can penetrate.

Valera clay, 0 to 1 percent slopes (VaA).--This soil is in the southeastern corner of the county. Mapped with it are small areas of Byrds clays and of shallow Valera clays. These included soils do not occupy more than 2 percent of any one area.

Because Valera clay, 0 to 1 percent slopes, is nearly level, it loses little water as the result of runoff. It is choice grassland. Capability unit IIs-1; range site, Deep Hardlands, Rolling Plains-Limestone.

Valera clay, 1 to 3 percent slopes (VaB).--This soil (fig. 5) occurs near Valera clay, 0 to 1 percent slopes. It generally occupies slopes that lead to drainageways.

Mapped with this soil are small areas of Byrds clays and of shallow Valera clays. The included soils do not occupy more than 5 percent of any one area.

Most of Valera clay, 1 to 3 percent slopes, is in range. If the soil is cultivated and not protected adequately, water is likely to cause moderate erosion. Capability unit IIe-4; range site, Deep Hardlands, Rolling Plains-Limestone.

VALERA CLAY, SHALLOW

The shallow Valera clays occur near areas of Valera clays. Except that they are less than 20 inches thick over limestone, they are similar to the Valera clays. Valera clays, shallow, have a dark-brown, strongly calcareous, very crumbly surface layer and a brown, strongly calcareous, clay subsoil that rests on broken limestone.

Figure 5.—Profile of Valera clay, 1 to 3 percent slopes, in which the strong, subangular blocky structure and the limestone bedrock are apparent.

The following describes a profile in a native pasture on a slope of about 1.5 percent (on Brooks Early Ranch, on a ridge between steep slopes of Tarrant stony clays, and about 1.5 miles northwest of the headquarters of the ranch):

A_{11} 0 to 7 inches, dark-brown (7.5YR 4/2) clay, (7.5YR 3/2) when moist; strong, fine, subangular blocky structure; hard when dry, firm but very crumbly when moist, and sticky when wet; many fine pores; few wormcasts; few pieces of chert and caliche gravel; many roots; strongly calcareous; gradual boundary.

A_{12} 7 to 16 inches, brown (7.5YR 5/3) clay, dark brown (7.5YR 4/3) when moist; moderate, fine, subangular blocky structure; very hard when dry, very firm when moist, and very sticky when wet; very few large, hard concretions and soft lumps of calcium carbonate; few roots; strongly calcareous; clear boundary.

C_{ca} 16 to 22 inches, light-brown (7.5YR 6/4), chalky clay that contains numerous coarse, soft lumps and hard concretions of calcium carbonate; abrupt boundary.

Dr 22 inches +, broken limestone.

The color of the surface soil ranges from brown to dark grayish brown. Depth to the C_{ca} horizon ranges from 10 to 20 inches. In many places the C_{ca} horizon is lacking. In some places the surface soil is clay loam to a depth of 4 to 5 inches.

Most of the soils of this soil type are in range. The forage produced on them is nutritious. The intake of water in the soils is moderately rapid.

Valera clay, shallow, 0 to 3 percent slopes (VcB).--This soil can be cultivated, but it requires careful management to prevent erosion by water. Capability unit IIIe-3; range site, Shallow Land, Rolling Plains-Limestone.

VALERA STONY CLAY

The soils in this soil type occur near the other Valera soils. They have pieces of limestone on the surface and throughout the surface layer. The stones resulted from the weathering of thin strata of limestone as the soils developed. The pieces of limestone are 6 to 18 inches in diameter. They range in number from 3 to 25 per 100 square feet. Depth of the soil between the stones ranges from 10 to 30 inches.

Valera stony clay, 0 to 3 percent slopes (VeB).--This soil is too stony for cultivation. It is well suited to pasture, and the forage is of good quality. Capability unit VIs-1; range site, Shallow Land, Rolling Plains-Limestone.

Vernon Series

The Vernon series consists of very shallow, reddish, strongly calcareous soils formed in material from the Permian red beds. The soil profile is weakly developed. The native vegetation was a sparse cover of short grasses.

These soils occur near the Foard, Hollister, Stamford, and Tillman soils and have formed from similar parent materials. They are shallower over the partially weathered red-bed material than any of the associated soils. The other soils all have at least 18 inches of soil material overlying the red-bed material.

Only one soil type in this series--Vernon clay--is mapped in the county.

VERNON CLAY

In this soil type the soils consist of 5 to 15 inches of red, strongly calcareous, sticky clay that overlies red, strongly calcareous clay from the partially weathered red beds.

The following describes a profile in a native pasture, on a convex slope of 2 percent (5 miles east of Haskell on the south side of State Highway 24):

A 0 to 10 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; weak, coarse and medium, irregular blocky structure; extremely hard when dry, very firm when moist, and very plastic and sticky when wet; strongly calcareous; few fine roots; gradual boundary.

C_1 10 to 30 inches, reddish-brown (2.5YR 4/5) clay, dark reddish brown (2.5YR 3/5) when moist; consistence same as that in the A horizon; massive; strongly calcareous; few fragments of blue shale; gradual boundary.

C_2 30 to 48 inches +, shaly clay that is the same color as the clay in the C_1 horizon; the C_2 horizon is parent material derived from the Permian red beds.

The A horizon ranges in color from red to reddish brown and in thickness from 5 to 15 inches. Numerous fragments of blue shale occur on the surface in many places. In many places there are strata of blue shale in the soil.

The soils in this soil type are nearly all in range. A few small areas are in crops, but yields are very low.

Vernon clay, 3 to 8 percent slopes (VnD).--Most of this soil is in range, to which it is fairly well suited. Mapped with it are areas of Stamford and shallow Tillman soils. These included soils are deeper than Vernon clay, 3 to 8 percent slopes, and do not occupy more than 15 percent of any one area.

Vernon clay, 3 to 8 percent slopes, absorbs water very slowly. It will be eroded severely by water if it is not managed carefully. Capability unit VIe-3; range site, Shallow Hardlands, Rolling Plains.

Vernon complex (Vr).--The soils of this complex occur near areas of Vernon clay, 3 to 8 percent slopes. In places severe erosion has removed all of the surface layer from the soils and has cut deep into the red-bed parent material. As a result, the topography is rough.

The soils are not suited to crops, and they are only poorly suited to range. Capability unit VIIe-1; range site, Rough Breaks, Rolling Plains.

Wichita Series

The Wichita series consists of deep, reddish, noncalcareous soils. The soils are on old high terraces that are now above the level of overflow. They have developed under short grasses in old stream alluvium or outwash. The old alluvium consists of sediments washed mainly from soils developed in outwash, intermixed with materials from soils developed over red beds. The areas that have been cultivated are slightly eroded and have rills and other evidence of washing.

The Wichita soils occur near the Abilene, Enterprise, Miles, and Tipton soils. They are reddish and have a subsoil of blocky sandy clay or clay. Unlike the Wichita soils, the Abilene soils are dark grayish brown. The Enterprise soils lack a textural profile and have a texture of fine sandy loam to a depth of several feet. The Miles and Tipton soils have subsoils of sandy clay loam.

Two soil types in this series--Wichita clay loam and Wichita gravelly loam--are mapped in the county.

WICHITA CLAY LOAM

In this soil type the soils have a surface soil of reddish-brown clay loam, 6 to 8 inches thick. The subsoil is reddish-brown, sticky clay. In places there is a distinct layer of lime.

The following describes a profile in a nearly level, cultivated field (4.8 miles west of Rule and 1.5 miles south of State Highway 24):

A_{1p} 0 to 6 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) when moist; weak, fine, granular structure; very hard when dry, friable when moist, and slightly sticky when wet; noncalcareous; clear boundary.

A_{12} 6 to 10 inches, dark reddish-brown (5YR 3/4), heavy clay loam, (5YR 2/4) when moist; weak, moderate and fine, subangular blocky structure; very hard when dry, firm when moist, and sticky

when wet; many wormcasts; many medium pores; noncalcareous; clear boundary.

B_{21} 10 to 28 inches, dark reddish-brown (2.5YR 3/4) clay, (2.5YR 2/4) when moist; weak to moderate, medium, blocky structure; very hard when dry, very firm when moist, and sticky when wet; numerous fine pores; noncalcareous; gradual boundary.

B_{22} 28 to 42 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) when moist; weak, medium, blocky structure; consistence similar to that of B_{21} horizon; noncalcareous; clear boundary.

C_{ca} 42 to 56 inches, yellowish-red (5YR 4/6), light clay, (5YR 3/6) when moist; massive; hard when dry, friable when moist, and sticky when wet; numerous coarse, soft lumps of calcium carbonate comprise about 30 percent, by volume, of the soil mass; very strongly calcareous; diffuse boundary.

C 56 to 70 inches +, similar to the C_{ca} horizon, except that the soil material contains much less calcium carbonate.

The A_{1p} horizon ranges from brown to reddish brown in color, from sandy clay loam to clay loam in texture, and from 5 to 10 inches in thickness. In some areas there is a B_1 horizon. In an area on the north side of Millers Creek, north of Mattson, the B_{21} and B_{22} horizons are more sandy than in the normal soil. In most places depth to the C_{ca} horizon is between 36 and 60 inches, but in some places the C_{ca} horizon is lacking. In a large area just southeast of Haskell, depth to the C_{ca} horizon ranges from 20 to 40 inches.

The soils in this soil type occur in all parts of the county except in the southwestern and southeastern corners. The soils are well suited to crops, and most of the acreage is cultivated. The soils absorb water slowly, but they retain it well. Crops produce good yields on them, even in dry years.

Wichita clay loam, 0 to 1 percent slopes (WcA).--This nearly level soil is easy to work. It loses little water as the result of runoff, and there is little risk of erosion. Crops grown on this soil make high yields. Capability unit IIc-1; range site, Deep Hardlands, Rolling Plains.

Wichita clay loam, 1 to 3 percent slopes (WcB).--This soil occurs near Wichita clay loam, 0 to 1 percent slopes, on slopes between that soil and drainageways. The soil loses some water as the result of runoff. It is likely to be eroded if it is not protected. Capability unit IIe-2; range site, Deep Hardlands, Rolling Plains.

Wichita clay loam, 1 to 3 percent slopes, eroded (WcB2).--This soil has been damaged by gullying and sheet erosion. It is otherwise similar to Wichita clay loam, 1 to 3 percent slopes, and occurs in similar positions. Capability unit IIIe-2; range site, Deep Hardlands, Rolling Plains.

WICHITA GRAVELLY LOAM

In this soil type the soils consist of 4 to 10 inches of brownish gravelly loam over reddish-brown gravelly clay that is 3 to 8 feet thick. From 20 to 90 percent of the subsoil is made up of gravel.

The following describes a profile by a deep gravel pit (2.5 miles southeast of Haskell along a county road):

A_1 0 to 8 inches, brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 4/4) when moist; structureless; friable when moist, nonsticky when wet; pH 7.0; abrupt boundary.

B_2 8 to 60 inches +, reddish-brown (5YR 5/4) gravelly clay, (5YR 4/4) when moist; structureless; the gravel is mostly rounded quartzite and hard concretions of calcium carbonate and comprises about 60 percent, by volume, of the soil material.

Wichita gravelly loam, 1 to 5 percent slopes (WgB).--This soil occurs near areas of Wichita clay loams that contain more sand than the normal Wichita clay loam. It is poorly suited to crops. Yields are low and the crops often fail. Capability unit VIe-1; range site, Mixed Land, Rolling Plains.

Yahola Series

The Yahola series consists of reddish, calcareous, sandy, alluvial soils that have a sandy subsoil. They are made up of sediments washed from sandy soils developed in outwash and in sandy material from red beds.

The Yahola soils occur near the Miller and Norwood soils and near areas of Alluvial land. Unlike the Yahola soils, the Miller soils have a subsoil that is clayey, and the Norwood, a subsoil that is silty to loamy. Alluvial land is a mixture of different soils.

Only one soil type of this series--Yahola fine sandy loam--is mapped in this county.

YAHOLA FINE SANDY LOAM

The soils in this soil type have a surface soil of reddish-brown, calcareous fine sandy loam, 16 to 40 inches thick. The subsoil is reddish-brown, strongly calcareous, light fine sandy loam to loamy sand.

The following describes a profile in a native pasture (4.8 miles west of Rule, 5 miles north of State Highway 24, and 0.3 mile southeast of the channel of the Brazos River):

A 0 to 28 inches, yellowish-red (5YR 5/5) fine sandy loam, (5YR 4/5) when moist; structureless; soft when dry, very friable when moist, and nonsticky when wet; many fine roots; strongly calcareous; abrupt boundary.

AC 28 to 60 inches +, light fine sandy loam, color same as that of the A horizon; many thin strata ranging in texture from silty clay loam to loamy fine sand; strongly calcareous.

The A horizon ranges from light brown to reddish brown or yellowish red in color, from fine sandy loam to loamy fine sand in texture, and from 16 to 40 inches in thickness. Stratification in the AC horizon varies markedly within short distances.

The soils in this soil type are likely to be eroded by wind. In addition, water is lost as the result of percolation, and the water-holding capacity is low.

Nevertheless, the soils are fairly well suited to crops.

Yahola fine sandy loam (Ya).--This soil occurs on the bottoms along the Brazos River. Generally, it is next to the river channel or next to areas of Alluvial land, which are at a lower level between the channel and this soil. The areas of Yahola fine sandy loam are flooded occasionally, but they are not flooded often enough to prevent their use for crops. Capability unit IIe-3; range site, Bottom Land, Rolling Plains.

Use and Management of Soils

This section has several parts. The first explains the system of land capability classification used by the Soil Conservation Service. Next, is a discussion of general management practices that apply to all the soils. Then, management of capability groups of soils is described, and is followed by a discussion of estimated yields. The next part gives information about range management. Finally, the engineering properties of the soils are described.

Capability Groups of Soils

The capability classification is a grouping that shows, in a general way, how suitable soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, on the risk of damage when they are used, and on the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels--the capability class, subclass, and unit. The eight capability classes, the broadest grouping, are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the remaining classes have progressively greater natural limitations. In class VIII are soils and land types so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, grazing, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes, there can be as many as four subclasses. The subclass is indicated by adding a small letter, e, w, s, or c, to the class numeral, for example, IIe. The letter e shows that the main limitation is risk of erosion unless a close-growing cover of plants is maintained; w means that water in or on the soil will interfere with the growth of plants or with cultivation (in some soils the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, stony, or has low fertility that is difficult to correct; and c, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses w, s, and c because the soils in it have little or no erosion hazard but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units. These are groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other response to management. Thus, the capability unit is a convenient grouping for many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIw-2.

The eight classes in the capability system and the subclasses and units in this county are described in the list that follows.

Class I.--Soils that have few limitations that restrict their use.
- Unit I-1.--Deep, nearly level, moderately permeable soil.

Class II.--Soils that can be used for tilled crops but with some limitations that reduce the choice of plants or that require moderate conservation practices.
- Subclass IIc.--Soils that are limited for the production of crops by insufficient effective rainfall.
  - Unit IIc-1.--Deep, nearly level loams or clay loams that are moderately to slowly permeable.
- Subclass IIe.--Soils that have a moderate hazard of erosion when used for tilled crops.
  - Unit IIe-1.--Deep, nearly level to gently sloping or undulating fine sandy loams that are moderately permeable.
  - Unit IIe-2.--Deep, gently sloping loams and clay loams that are slowly permeable.
  - Unit IIe-3.--Deep, nearly level soil of the bottom lands with moderately rapid permeability.
  - Unit IIe-4.--Deep, gently sloping, clayey soils.
- Subclass IIs.--Soils moderately limited by a clay surface soil and a slowly permeable or very slowly permeable subsoil.
  - Unit IIs-1.--Nearly level, clayey soils that have a slowly permeable subsoil.
  - Unit IIs-2.--Deep, nearly level, very slowly permeable clay loams and clays.
  - Unit IIs-3.--Slowly permeable clay of the bottom lands.
- Subclass IIw.--Soils that are limited in their use for crops because of occasional overflow.
  - Unit IIw-1.--Deep, nearly level, moderately to slowly permeable clay loams of the bottom lands.

Class III.--Soils that have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.
- Subclass IIIe.--Soils that are subject to moderately severe erosion.
  - Unit IIIe-1.--Deep, gently sloping, very slowly permeable clay loams.
  - Unit IIIe-2.--Deep, gently sloping, eroded clay loams that are slowly permeable.
  - Unit IIIe-3.--Shallow, nearly level to gently sloping soils that are slowly to moderately permeable.
  - Unit IIIe-4.--Deep, gently sloping to undulating fine sandy loams that are moderately permeable and eroded.

Unit IIIe-5.--Deep, gently sloping fine sandy loam that has moderately rapid permeability.

Unit IIIe-6.--Deep, nearly level to undulating loamy fine sands that are moderately permeable.

Unit IIIe-7.--Strongly calcareous, moderately permeable clay loams.

Unit IIIe-8.--Moderately deep, very slowly permeable clays.

Subclass IIIw.--Soils limited by excess water.

Unit IIIw-1.--Deep, very slowly permeable clay in old lake beds.

Class IV.--Soils that have very severe limitations that restrict the choice of plants, that require very careful management, or both.

Subclass IVe.--Soils subject to moderately severe to severe erosion.

Unit IVe-1.--Moderately deep to deep, moderately sloping clays or clay loams that are very slowly permeable.

Unit IVe-2.--Shallow clay loams that are moderately to slowly permeable.

Unit IVe-3.--Deep fine sandy loams that are moderately to rapidly permeable.

Unit IVe-4.--Deep fine sandy loam with moderately rapid permeability, on alluvial fans.

Unit IVe-5.--Deep, hummocky or undulating loamy fine sands that are moderately to rapidly permeable.

Subclass IVw.--Soils subject to occasional to frequent overflow.

Unit IVw-1.--Deep, moderately permeable soils of the bottom lands.

Class V.--Soils that have little or no hazard of erosion but with other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or to food and cover for wildlife. (None in Haskell County.)

Class VI.--Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range, to woodland, or to food and cover for wildlife.

Subclass VIe.--Soils subject to moderate or severe erosion.

Unit VIe-1.--Shallow to deep, gently sloping to sloping soils, one of which is gravelly.

Unit VIe-2.--Deep, hummocky loamy fine sand that is rapidly permeable.

Unit VIe-3.--Very shallow, gently sloping to sloping soils.

Unit VIe-4.--Deep, rapidly permeable, sandy alluvial land.

Subclass VIs.--Shallow, stony soils.

Unit VIs-1.--Shallow to very shallow, gently sloping to sloping, stony soils.

Class VII.--Soils that have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIe.--Soils subject to very severe erosion.

Unit VIIe-1.--Strongly sloping, severely eroded soils.

Subclass VIIs.--Very shallow, stony soils.

Unit VIIs-1.--Very shallow, strongly sloping, stony clay.

Class VIII.--Soils and land types that have limitations that preclude their use for commercial production of plants and that restrict their use to recreation, or wildlife, or they may have scenic value or provide a supply of water. (None in Haskell County.)

General Management Practices

The chief problems in using and managing the soils in Haskell County are control of soil erosion, conservation of moisture, use of suitable cropping systems, use of suitable crops and of good methods of tillage, and maintenance of an adequate level of fertility. Most of the soils in the county require protection from wind and water erosion. About one-half of the soils have slopes of more than 1 percent and are subject to accelerated water erosion if they are cultivated.

Some problems of management are common to all the soils of the county; others are common to only certain groups of soils. Generally, a combination of practices is needed. To simplify discussion, some aspects of management that apply to all the soils are mentioned first. Then, the problems that apply to groups of soils, that is, the capability units, are considered.

Farmers, ranchers, and other landowners may need assistance in planning the management of their soils. The local representative of the Soil Conservation Service, the county agent, or a representative of the Texas Agricultural Experiment Station can help determine the best practices to use.

Terraces.--Terraces in Haskell County are used to conserve water, to help control erosion, and to divert surplus water from cropland or other areas that need protection.

On large, smooth areas of nearly level soils, terraces are used mainly to conserve water (fig. 6). In these areas, the terraces are broad and gently rounded so that ordinary farm machinery can be used on them. They are built on the contour and blocked at both ends to hold water.

Figure 6.—Level, closed terrace designed to hold the water until it can soak into the soil.

On sloping soils the terraces are built on the contour but one end is left open. From the open end, surplus water flows onto a pasture or into a protected waterway. These terraces help to control erosion and to conserve water.

Terraces built to divert surplus water away from cropland or gullies are called diversion terraces. These terraces carry the water along a slight grade to a pasture or prepared waterway.

Terraced fields should be farmed on the contour and parallel to the terraces. Farming in this way will help to maintain the terraces as well as to reduce runoff and control erosion.

An engineer's level is needed to lay out terraces properly. Technical assistance in designing terraces can be obtained from a local representative of the Soil Conservation Service.

Grassed waterways.--Grassed waterways should be established to carry away runoff that would otherwise collect in natural drainageways, behind terraces, or in drainage or irrigation systems. If properly prepared, they are helpful in controlling erosion (fig. 7).

If a waterway is to be established, design and begin to prepare it at least 2 years before it is to be used. Shape the waterway and drill the areas to sudangrass, forage sorghum, or some other annual crop that will produce a large amount of residue. Do not let the crop make seed, but use it as a litter crop. Then, seed the perennial grasses that will provide permanent cover for the waterway in the residue left by the litter crop. Seed the permanent grasses well up on the sides of the waterway and into the terrace outlets. If a waterway has a wide, flat bottom so that the velocity of water remains low, it can be seeded to wheat or oats instead of grass. Keep residue from the oats or wheat on the surface, however, during periods when there is no crop growing in the waterway.

Contour farming.--Contour farming consists of plowing, planting, and tilling across the slope. Contour lines can be established by using an engineer's level. In terraced fields the terraces will serve as guidelines. Furrows that run across the slope will slow or stop the movement of water in contour farming. Water from rainfall will then soak into the soil and will be available to plants. Also, water erosion is reduced.

Figure 7.—An old gully in which a waterway has been established to carry water from the terraces and down the slope.

Suitable crops.--Because of the small amount of rainfall in the county, the kinds of crops that can be grown successfully are limited. Using and managing the soils so that the most profit can be derived from these crops is important. At the same time, the farm operator needs to protect the soils from erosion.

Cotton is the principal cash crop in the county. Grain sorghum is harvested as a cash crop, and forage sorghum is grown for fodder and silage. Wheat, oats, and barley are the main small grains grown. They are used for grazing or as cash crops.

Summer peas are generally planted in rows and are grown as soil-improving crops. They consist of Chinese red, whippoorwill, black-eyed peas, and varieties of crowder and Brabham peas. Guar is another suitable legume grown in summer. It is grown for seed or as a soil-improving crop. The seed provides gum that is used in food, cosmetics, and paper. The byproducts of the seed provide a high-protein feed for livestock.

Austrian winter peas and vetch are broadcast, drilled, or planted as soil-improving crops in rows that are run close together. Sudangrass is planted in rows and is used for grazing.

Other suitable crops are sorghum almum, blue panicum, and green sprangletop. These crops are new in the county. They are planted in rows and are used for hay, for grazing, or as soil-improving crops.

Small grains, sorghums, sudangrass, vetch, Austrian winter peas, and perennial grasses all produce large amounts of residue. A large part of the residue is the topgrowth, but these crops also generally have an extensive root system.

Protection from wind erosion.--Tillage that leaves the surface cloddy or rough helps to reduce damage by wind. Deep plowing is the most common and effective tillage practice used. In deep plowing, 3 to 6 inches of the sandy clay in the subsoil is turned up.

The farmer needs to be sure that he is turning up part of the sandy clay subsoil and not just part of the darker or more reddish, sandy surface soil. A simple test can be made to determine if the soil turned up is subsoil. Pick up some of the plowed soil and moisten it. A soil that becomes sticky contains clay and is part of the subsoil. The stickier the soil, the more clay it contains. Deep plowing is not a permanent answer to the control of wind erosion. It is best used to help get a cover of vegetation started. The cover of vegetation will provide a permanent means of controlling wind erosion. Temporary control of wind erosion can be provided by listing, which also leaves the surface rough.

Applying phosphate or a nitrogen fertilizer in moderate amounts will increase yields in most years.

Stripcropping.--Stripcropping consists of growing different crops in alternate strips to help reduce erosion from water and wind. To reduce erosion by water, plant the strips on the contour and alternate strips of clean-tilled crops with strips of closely spaced crops that produce a large amount of residue. For example, plant one strip to cotton and the next

to grain sorghum. Forage sorghum or a small grain can be used in place of the grain sorghum. Rotating the crops in the strips so that different crops are grown from year to year helps to maintain favorable tilth and a good supply of plant nutrients and organic matter.

To help reduce wind erosion in the sandy soils, alternate strips of cotton and sorghum, or small grain can also be used. Here, the most benefit is obtained by using narrow strips. The strips should be run at right angles to the direction of the prevailing winds.

Cropping systems.--Growing crops in a suitable cropping system helps to keep a supply of plant nutrients in the soil and to maintain satisfactory yields. It also helps to control insects and to protect the crops from cotton root rot and other diseases. Generally, a suitable cropping system provides a legume or other soil-improving crop once in 3 to 5 years.

In Haskell County more than 80 percent of the cropland each year is planted to row crops, mainly cotton and grain sorghum. The soils have been used for row crops so long that their structure has deteriorated, the content of organic matter is lower than formerly, and fertility has been reduced.

In some places winter peas, guar, and summer peas have been included in the cropping system to improve the soil. Yields of crops following these legumes do not always increase, because the legumes deplete the supply of moisture available for the next crop. Consequently, many farmers hesitate to grow legumes or other soil-improving crops. The benefits of growing a soil-improving crop, however, more than offset harm resulting from loss of moisture. Soil-improving crops better the structure of the soil, make it more porous, and increase the supply of organic matter.

Crop residue management.--Crop residues properly used benefit the soil and are economical to use. The organic matter in the plant residues is used by soil organisms as a source of nutrients and energy. An abundance of organic matter generally means higher fertility in the soil, better tilth, and better control of erosion.

A good litter of crop residues left on the surface of the soil (fig. 8) or worked partially into the uppermost few inches reduces runoff and erosion caused by wind or water. It will also protect the surface from packing rains, reduce crusting and sealing over, increase the intake of water, and will reduce evaporation and shade the soil, thus reducing temperatures. In addition, it will add organic matter to the soil, improve the tilth of the surface soil, and reduce packing by farm machinery. The residues will decay more quickly if nitrogen fertilizer is scattered over them before they are plowed under. Care and adequate equipment are needed to do the farming operations necessary to keep crop residues on the surface or mixed into the soil.

Tillage.--Proper tillage is important in managing soils. If tillage is done in the wrong way, or if it is done too often or at the wrong time, it can be harmful. Tillage is needed primarily to prepare a good seedbed, to kill weeds, and to improve the general condition of the soil.

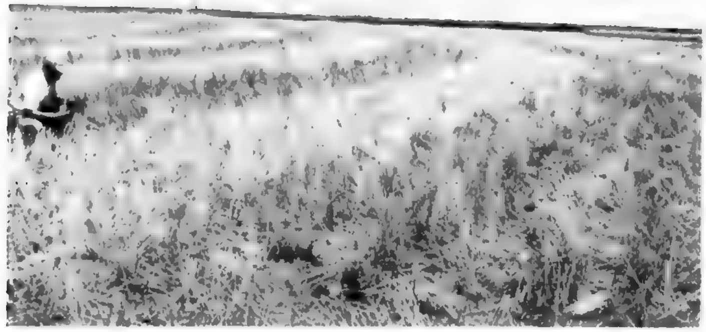
Figure 8.—Wheat stubble left in the field protects the soil from the sun and packing rains. It also helps reduce runoff.

If the soil is too wet when tilled, structure of the soil breaks down and a plowpan is likely to form. The plowpan restricts the growth of roots and slows the penetration of water. Consequently, much water is lost as the result of runoff. Sometimes, however, emergency tillage is necessary; for example, tillage may be necessary soon after rains to protect the soils from wind erosion. Using the right kind of tillage and tillage implements for the particular job will get the best results.

Fertilizer.--Fertilizer is not commonly used in the county. Results of soil tests show that most of the soils are low to very low in nitrogen and phosphorus. Trial uses of fertilizer, however, have not produced consistent increases in yields. Under dryland farming, the sandier soils, such as the Miles and Springer loamy fine sands, give higher response to fertilizer than other soils in the county. These sandy soils will produce even higher yields if they are irrigated. Most of the increased yields have been obtained in years of above-normal rainfall.

Management by Capability Units

Soils in one capability unit have about the same limitations and similar risks of damage. The soils in one unit, therefore, need about the same kind of management. In the following pages the soils in each of the capability units are listed and management is described for each unit.

Capability unit I-1

Only one soil--Tipton loam, 0 to 1 percent slopes--is in this capability unit. This deep, nearly level soil is moderately permeable. Most of it is in the northwestern part of the county. About three-fourths of the acreage is cultivated.

This soil is easy to manage and loses little water as the result of runoff. Water erosion is not a problem, but wind causes some damage if fields are left bare during the blowing season. The soil is

productive and holds large amounts of water available for plants. Nevertheless, it needs a soil-improving crop occasionally to help maintain productivity.

Capability unit IIc-1

Deep, moderately to slowly permeable, nearly level soils make up this capability unit. They occupy about one-fifth of the county. About three-fourths of the acreage is cultivated. The following soils are in this unit:

Abilene clay loam, 0 to 1 percent slopes.
Abilene loam, 0 to 1 percent slopes.
Hollister clay loam, 0 to 1 percent slopes.
Portales clay loam, 0 to 1 percent slopes.
Wichita clay loam, 0 to 1 percent slopes.

These soils are easy to manage and are productive. The Abilene and Hollister soils occur in large, smooth areas. The other soils occupy smaller acreages. All of the soils are well suited to the crops commonly grown in the area. They hold moderate amounts of water available for plants and lose little water as the result of runoff. In some areas, however, there are long, gentle, uniform slopes of 1/2 to 1 percent. Here, if the soils are not protected, runoff is likely to cause slight sheet and rill erosion. Except in bare, untilled fields, wind erosion is not a problem. Terraces and tillage on the contour will help to control erosion on the long, gentle slopes; they will also help to conserve moisture.

A suitable cropping system provides, once in every 3 or 4 years, a crop that will produce a large amount of residue and, once in 5 or 6 years, a soil-improving crop.

A well-planned cropping system will help to maintain a supply of organic matter in the surface layer and in the subsoil. It also improves the structure and the tilth of the soils.

Capability unit IIe-1

The soils in this capability unit are deep, nearly level to gently sloping and undulating, and moderately permeable. They occur mostly in the northwestern part of the county. More than 90 percent of the acreage is cultivated. The soils in this unit are:

Abilene-Miles complex.
Miles fine sandy loam, 0 to 1 percent slopes.
Miles fine sandy loam, 1 to 3 percent slopes.
Miles fine sandy loam, undulating.
Portales fine sandy loam, 0 to 1 percent slopes.

These soils are well suited to cultivated crops, and the average yields are among the highest in the county. The soils are sandy. If they are not protected, they will be eroded by wind. In many places many of the finer particles of silt and clay, formerly in the uppermost 4 to 6 inches of the soils, have been sifted and blown away by wind.

To help control erosion by wind, keep a cover of growing crops or crop residues on the soil or use tillage to make a rough, cloddy surface during the blowing season. Wheat, oats, barley, rye, winter peas, and vetch can be grown to provide protection from wind. If these crops are planted early in fall, they make fair to good growth before the blowing season begins.

The nearly level areas of Miles fine sandy loams hold large amounts of water available for plants. Sorghum, grown on the Portales soil, is damaged by chlorosis, or yellowing of the leaves, which is probably caused by the high content of lime in the soil.

Growing a crop every 2 or 3 years that will produce a large amount of residue will help to keep a supply of organic material in the surface soil. To help maintain a supply of organic material in the subsoil as well as in the surface soil, grow a soil-improving crop once in 3 to 5 years.

In the nearly level areas, farming on the contour and using crop residues properly will help to prevent losses of water as the result of runoff. In areas where the slope is more than 1 percent, terraces are needed to control erosion and to prevent loss of water through runoff. In the undulating areas water from runoff is trapped in the low places and remains on the surface for short periods during and after heavy rains. If the undulating areas are irrigated, sprinkler irrigation instead of other types is required unless the mounds and billows are leveled.

Capability unit IIe-2

The deep, gently sloping, slowly permeable soils that make up this capability unit occur in all parts of the county. More than one-half of the total acreage is cultivated. The soils in this unit are:

Abilene loam, 1 to 3 percent slopes.
Abilene clay loam, 1 to 3 percent slopes.
Hollister clay loam, 1 to 3 percent slopes.
Wichita clay loam, 1 to 3 percent slopes.

These soils are productive and are moderately well suited to the crops commonly grown in the area. They are used and managed about the same as the soils in capability unit IIc-1. Because of their mild slopes, however, they lose more water through runoff than do the soils in unit IIc-1. Consequently, they are more likely to erode.

Terraces and contour tillage will help to prevent much of the runoff and will protect the soils from erosion. Close-growing crops and crops that produce a large amount of residue should be grown every 2 or 3 years. The soils can be farmed satisfactorily without terraces if small grains and grain sorghum are grown every year in closely spaced rows on two-thirds to three-fourths of the acreage.

Capability unit IIe-3

Only one soil--Yahola fine sandy loam--is in this capability unit. This deep, nearly level, bottom-land soil has moderately rapid permeability. It occurs on the flood plains of the Brazos River but is flooded only occasionally. About one-half of the acreage is cultivated.

This soil is productive. It is suited to all the crops commonly grown in the area. The soil is susceptible to wind erosion, and its sandy substratum causes it to be droughty.

This soil absorbs water readily and loses little of it as the result of runoff. A crop that produces a

large amount of residue should be grown continuously on one-third to one-half of the acreage to protect the soil from wind erosion. This crop will also help to build up the content of organic matter in the soil.

Capability unit IIe-4

The soils in this capability unit are deep and clayey. They are gently sloping; consequently, they are likely to be eroded by water. The soils in this unit are:

Byrds clay, 1 to 3 percent slopes.
Roscoe clay, 1 to 3 percent slopes.
Valera clay, 1 to 3 percent slopes.

Terracing and contour tillage will help to reduce the amount of water lost as the result of runoff and will help to control water erosion. Otherwise, these soils can be used and managed about the same as the soils in capability unit IIs-1.

Capability unit IIs-1

Nearly level, clayey soils that have a slowly permeable subsoil make up this capability unit. The soils are fairly extensive. The soils in this unit are:

Byrds clay, 0 to 1 percent slopes.
Roscoe clay, 0 to 1 percent slopes.
Valera clay, 0 to 1 percent slopes.

The Roscoe and Valera soils occur in large, smooth areas, but the Byrds soil is less extensive. All of the soils are productive. They lose some water as the result of runoff, but they hold a fair amount available for plants. Runoff causes little erosion.

The clayey surface layer of these soils dries out slowly after rains and makes it difficult to prepare a good seedbed. Working the soils when the content of moisture is too high breaks down the structure, and, as a result, tilth becomes poor. Keeping large amounts of organic matter, crop residues, or cotton burs on the surface, or partially working them into the soil to a depth of 1 to 4 inches helps to improve tilth. Although terraces are not needed to control erosion, they will help to conserve moisture.

Capability unit IIs-2

The soils in this capability unit are deep, nearly level, and very slowly permeable. They occur in all parts of the county except the northwestern. About one-half of the acreage is cultivated. The soils in this unit are:

Foard clay loam, 0 to 1 percent slopes.
Tillman clay loam, 0 to 1 percent slopes.
Tillman-Foard complex, 0 to 1 percent slopes.

These soils are important for crops and range. They are moderately well suited to cultivation and are moderately productive. The soils are better suited to small grains, which grow well in cool seasons, than to most other crops. They are also suited to vetch and to summer and winter peas, but cotton and grain sorghum are also grown. Hubam and Madrid sweetclovers can be grown, but stands are hard to establish.

These soils can be used for crops without damage, but their tight consistence and the claypan in the subsoil limit their use. The subsoils absorb water very slowly, so roots cannot penetrate and spread out readily. Small grains, sorghum almum, sorghums, and similar crops that produce large amounts of crop residues should be grown. Keeping the residues on the surface or working them partly into the surface layer will increase the intake of water. Growing these crops every other year, if feasible, will also help to make the clayey subsoil more friable and more permeable to air, water, and roots.

Because water infiltrates these soils very slowly, much of it is lost through runoff. The runoff causes little or no erosion. Terracing and tilling on the contour will help to conserve water.

Tillage must be done when the soils are neither too wet nor too dry. If the soils are tilled when too wet, their structure is broken down and they become cloddy. They are then difficult to work down to a good seedbed. Working organic matter into the surface layer will help to improve the seedbed.

Capability unit IIs-3

Only one soil--Miller clay--is in this capability unit. It is a slowly permeable soil on bottom lands along the Brazos River and the larger creeks. Some areas are flooded, but not frequently enough to prevent using the soil for crops. Erosion is not a problem.

The clayey surface soil crusts, so a good seedbed is difficult to prepare. Adding large amounts of organic matter will help to prevent crusting and will improve the tilth of the soil. This soil is better suited to grain sorghum, cotton, and alfalfa than to other crops. The soil is droughty, however, and in dry years crops are sometimes damaged.

Capability unit IIw-1

The soils in this capability unit are deep, nearly level, and moderately to slowly permeable. They are bottom-land soils that occur along the local streams and along the Brazos River. Many of the areas are narrow and are crisscrossed by the channels of meandering streams that frequently overflow. The soils are made up partly of sediments that are only partially weathered. The soils in this unit are:

Miller silty clay loam.
Norwood silty clay loam.

The use of some areas of these soils for crops is limited by the risk of flooding and by their location in areas crisscrossed by streams. The use of others is limited because they occur within large ranches. Only a small acreage is cultivated. The soils are moderately well suited to all of the crops commonly grown in the county. They are easy to manage and lose little water as the result of runoff. Occasionally, flooding harms the crops and also damages the soil by scouring or by leaving deposits of fresh sediments.

Yields of crops are lower on these soils than on most of the upland soils in the county. Adding large amounts of organic matter will help to make the soils more productive.

Capability unit IIIe-1

The soils in this capability unit are deep, gently sloping, and very slowly permeable. They are in all parts of the county except the northwestern. About one-half of the acreage is cultivated. The following soils are in this unit:

Foard clay loam, 1 to 3 percent slopes.
Foard clay loam, 1 to 3 percent slopes, eroded.
Tillman clay loam, 1 to 3 percent slopes.
Tillman clay loam, 1 to 3 percent slopes, eroded.

These soils are moderately well suited to crops and are moderately productive. They are better suited to small grains than to other crops. They are also suited to vetch, summer peas, and winter peas. Cotton, sorghum almum, and sorghum for grain and for fodder can be grown on them. Hubam and Madrid sweetclovers can be grown, but a stand of clover is hard to establish because of the difficulty of preparing a good seedbed.

The main problems in managing the soils are droughtiness and the risk of erosion by water; these are caused by the tight subsoils, which resemble a claypan. On about 10 percent of the acreage, erosion has been moderately severe. Terracing and tilling on the contour will help to protect the soils from water erosion. The terraces need protected outlets that will carry away surplus water during heavy rainfall. Water will stand behind a closed terrace during periods of heavy rainfall and will damage or kill the crop. The terraces should empty into a pasture or into prepared waterways.

Proper use of the residues from small grains, sorghum almum, sorghums, and other crops that produce large amounts of residue will improve the structure and tilth of the soils. The residue will also protect them from erosion. Crops that produce large amounts of residue need to be grown on one-half to two-thirds of the acreage each year. A soil-improving crop should be grown once in 3 to 5 years and may be substituted for the crop that produces large amounts of residue. A soil-improving crop will help to make the subsoil somewhat more porous.

Erosion needs to be controlled in the eroded areas before practices are applied to improve the soils. Eroded areas in these soils can be managed the same as the soils in capability unit IIIe-2.

Capability unit IIIe-2

The soils in this capability unit are deep, gently sloping, and slowly permeable. They are eroded. They occur in many parts of the county, but the total acreage is small. More than three-fourths of the acreage is cultivated. The following soils are in this unit:

Abilene clay loam, 1 to 3 percent slopes, eroded.
Wichita clay loam, 1 to 3 percent slopes, eroded.

These soils are suited to cultivation, but they have been damaged by water erosion. If erosion is controlled, their productivity can be restored. Terracing and tilling on the contour will help to protect them from further erosion. The terraces require protected outlets that will carry excess water into a pasture or a grassed waterway. Crops that produce a large amount of residue should also be grown.

Adding large amount of organic matter will help to restore the structure of the soil and will improve tilth. The organic matter will also help to control erosion. It can be supplied by growing small grains, vetch, winter peas, summer peas, sorghum almum, or other kinds of sorghum continuously for 4 or 5 years. Place additional organic matter on the more eroded areas where crops do not grow well; cotton burs or other crop residues can be brought from other fields. After the soils have been managed in this way for 4 to 6 years, they can then be managed about the same as soils in capability unit IIe-2.

Capability unit IIIe-3

The soils in this capability unit are shallow and are nearly level to gently sloping. They are slowly to moderately permeable. The soils occur throughout the county, and about 28 percent of the acreage is cultivated. The following soils are in this unit:

Byrds clay, shallow, 0 to 3 percent slopes.
Tillman clay loam, shallow, 0 to 3 percent slopes.
Valera clay, shallow, 0 to 3 percent slopes.

These soils are low in productivity. They are droughty and are susceptible to erosion by water. Generally, the soils have a layer of caliche or of broken limestone at a depth between 10 and 24 inches. The Byrds and Valera soils have a layer of broken limestone. The Tillman soils have an indistinct layer of caliche, but the red-bed parent material is at a depth between 20 and 30 inches.

These soils are better suited to crops that grow well in cool seasons than to other crops. Such crops include small grains, winter peas, and vetch. Cotton, sorghum almum, sorghum for grain and for fodder, and summer peas can be grown, but yields are low. Hubam and Madrid sweetclovers can also be grown.

Using terraces that have protected outlets, tilling on the contour, and adding crop residues will help to control water erosion. Growing crops that produce large amounts of residues on about one-half the soils each year and growing a soil-improving crop every 3 or 4 years will help to maintain productivity.

Capability unit IIIe-4

The soils in this capability unit are deep, eroded, gently sloping to undulating, and moderately permeable. They are not extensive, but most of the acreage is cultivated. The following soils are in this unit:

Miles fine sandy loam, 1 to 3 percent slopes, eroded.
Miles fine sandy loam, undulating, eroded.

These soils would be more productive if they had not been eroded. Most of the erosion on the undulating areas has been caused by wind. Most of the erosion on the areas that have simple, uniform slopes has been caused by water. On the areas that have simple, uniform slopes, terraces will help to protect the soils from erosion and will also conserve moisture. Terraces are not practical on the undulating areas.

Keeping a cover on these soils during the blowing season will reduce damage by wind erosion. Small grains, rye, vetch, or winter peas that have been broadcast can be grown to provide cover, or crop residues can be used. Listing or other tillage that leaves the surface rough or cloddy can be used to protect the soils from wind erosion in areas that lack crop residues. A cover crop will also reduce water erosion and help to maintain productivity. Adding phosphate or a fertilizer that contains nitrogen will also increase productivity.

Capability unit IIIe-5

Only one soil--Enterprise fine sandy loam, 1 to 3 percent slopes--is in this capability unit. This deep, gently sloping soil has moderately rapid permeability. It occurs in small areas in the extreme northwestern part of the county.

Erosion by wind and water and the sandy texture and rapid permeability of the subsoil are the principal problems in managing this soil. The soil is moderately productive. It holds water available for plants, but, because of the sandy texture of the subsoil, part of the water moves downward out of the reach of roots.

Terraces are not feasible because the subsoil does not contain enough clay to bind the soil together. Proper use of a vegetative cover, either of growing crops or of crop residues, is required to protect the soils from erosion by wind and water. Without a vegetative cover, the soil requires listing or other tillage that leaves the surface rough enough to prevent damage by wind. Growing a crop that produces a large amount of residue on two-thirds of the soil each year will keep water erosion to a minimum.

Using plant residues and growing soil-improving crops every 3 or 4 years will help reduce the amount of water lost through the subsoil. The productivity of the soil can be increased in most years by adding phosphate and nitrogen fertilizer.

Capability unit IIIe-6

The soils in this capability unit are deep, nearly level to undulating, and moderately permeable. They are in the northwestern part of the county. Most of the areas are cultivated. The soils in this unit are:

Altus loamy fine sand.
Miles loamy fine sand, undulating.
Springer-Altus loamy fine sands.

These soils are productive. Yields of cotton and grain sorghum grown on them are among the highest in the county. Although the soils are sandy, they are not droughty. Erosion caused by wind is the principal management problem. In nearly all fields that have not been deep plowed, the finer particles of silt and clay have been removed from the uppermost 6 to 8 inches.

Wind erosion can be reduced by keeping a cover of vegetation on the soils. Use plant residues or grow a cover crop. Allow grass and weeds to grow late in summer or early in fall to increase the amount of plant residues. The stubble of grain sorghum, cut as high as feasible and left standing, will help reduce soil blowing; residues of other crops should be left on the surface.

Wheat, oats, rye, winter peas, and other cover crops, planted early in fall, generally will make enough growth to protect the soils by the time the blowing season arrives. Drilling a cover crop between the rows of cotton in fall is also helpful in reducing soil blowing. Wind erosion that occurs in isolated spots can be controlled by spreading cotton burs on the areas. In summer, on about one-half of the acreage each year, grow sorghum, sorghum almum, or similar crops that produce a large amount of residue. Growing a soil-improving crop once in 2 to 4 years will help to maintain productivity.

Capability unit IIIe-7

The soils in this capability unit are strongly calcareous and are moderately permeable. They are poorly suited to crops. The soils in this unit are:

Drake clay loam, 1 to 3 percent slopes.
Mansker clay loam, 0 to 3 percent slopes.

These soils are subject to erosion. The Drake soil is on old, low dunes. The Mansker soil is shallow over a layer of lime. The soils are better suited to small grains, winter peas, vetch, and other crops that grow well in cool seasons than to other crops. Cotton, sorghum almum, other kinds of sorghums, and summer peas can be grown, but yields are low. Sorghums grown on these soils are damaged by chlorosis, or a yellowing of the leaves.

Terracing and tilling on the contour will help to reduce runoff and control erosion. Growing crops that produce a large amount of residue on one-half of the acreage each year and growing a soil-improving crop once in 3 or 4 years will help improve productivity.

Capability unit IIIe-8

The soils in this capability unit are moderately deep and are very slowly permeable. They occur throughout the southern and eastern parts of the county. The soils in this unit are:

Owens clay, 1 to 3 percent slopes.
Stamford clay, 1 to 3 percent slopes.

These soils are droughty and are susceptible to moderately severe erosion. They are low in productivity. The soils generally are too wet or too dry to be worked into a good seedbed.

These soils are better suited to small grains, winter peas, vetch, and other crops that grow well in cool seasons than to other crops. Cotton, sorghums, and summer peas can be grown, but yields are low.

Terracing and tilling on the contour will help reduce runoff and control water erosion. Every other year, if a small grain, sorghum almum, sorghums, or similar crops that produce a large amount of residue are grown, a cover of organic material will be left on the surface, tilth will improve, and the soil will be protected against erosion. Growing a soil-improving crop once in 2 or 3 years will help make the tight subsoil more open and porous.

Capability unit IIIw-1

Only one soil--Randall clay--is in this capability unit. This deep, very slowly permeable soil is in the beds of old lakes in many parts of the county. Runoff water from soils on the surrounding slopes occasionally collects on the areas. A few of the areas are too wet most of the time to be used for crops. Some of the areas can be used for crops, except in years when rainfall is unusually high. If this soil can be protected from runoff, it is easy to manage. It can then be used and managed like those in capability unit IIs-1.

Capability unit IVe-1

The soils in this capability unit are moderately deep to deep and are moderately sloping. They have very slow permeability. Most of the areas are in the eastern part of the county. The soils in this unit are:

Stamford clay, 3 to 5 percent slopes.
Stamford clay, 3 to 5 percent slopes, eroded.
Tillman clay loam, 3 to 5 percent slopes.

These soils are better suited to range than to cultivated crops, but about one-third of the acreage is cultivated. The soils are droughty. If cultivated, they are likely to be eroded by water.

The soils are better suited to wheat, oats, barley, and rye, which are grown during cool seasons, than to other crops. These crops also produce large amounts of crop residues that help to control water erosion. Sorghum almum and other sorghums can be grown, but yields are low and sometimes the crops fail.

Terracing, tilling on the contour, and using crop residues properly will reduce the amount of water lost through runoff and will prevent most of the erosion caused by runoff. The terraces should have protected outlets to permit excess water to flow onto a pasture or into a grassed waterway. If legumes are grown occasionally, they will help to improve the productivity of the soils.

Eroded, cultivated areas that are near a pasture should be converted to pasture. This can be done by seeding a mixture of side-oats grama, blue grama, and buffalograss or some other suitable mixture. The grasses must be well established before grazing is permitted.

Capability unit IVe-2

The soils in this capability unit are shallow and are moderately to slowly permeable. They occur in nearly all parts of the county. The areas are fairly small and are long and narrow. The soils in this unit are:

Mansker clay loam, 1 to 5 percent slopes, eroded.
Tillman clay loam, shallow, 3 to 5 percent slopes.
Tillman clay loam, shallow, 1 to 5 percent slopes, eroded.

These soils are not well suited to cultivation. They are better suited to crops that grow well in cool seasons than to other crops. Many areas adjoin large, smooth areas of other soils, however, and the soils are generally farmed the same as the adjoining soils. As a result, more than one-half of the total acreage is cultivated.

Although they are more droughty, these soils can be used and managed about the same as the soils in capability unit IVe-1. In addition to being droughty, the Mansker soil has a layer of caliche at a shallow depth. Red-bed parent material is at a shallow depth in the Tillman soils. In many places the caliche or red-bed material has been exposed by water erosion. Here, cotton burs, crop residues from other fields, or other organic material is needed to help control erosion and restore productivity. Adding phosphate and a nitrogen fertilizer for a few years will stimulate plants to grow, increase yields, and improve the tilth of the soils.

Eroded areas that are being cultivated should be returned to grass for a few years. If such areas are near a pastured area, they can be pastured when grass becomes established.

Capability unit IVe-3

The soils in this capability unit are deep and are moderately to rapidly permeable. They are in the northwestern part of the county. About one-half of the acreage is cultivated. The soils in this unit are:

Enterprise fine sandy loam, 1 to 5 percent slopes, eroded.
Miles fine sandy loam, 3 to 5 percent slopes, eroded.

These soils are likely to be eroded by water and wind and are not well suited to tilled crops. They are better suited to small grains, sorghum almum, and sorghums than to other crops.

On the Miles soil, terraces can be used to help control water erosion. Terraces cannot be used on the Enterprise soil because of its instability. Growing crops that produce a large amount of residue and using crop residues properly will control most of the erosion caused by wind and water. The most effective way of preventing erosion by wind is to keep a crop growing on the soil during the period when wind erosion is most likely to occur. If sorghum almum or sorghums are planted broadcast or in 20-inch rows, better protection will be provided against erosion. The residues from these crops should be left standing or lying on top of the soils during the blowing season.

Adding a fertilizer high in nitrogen and phosphorus will increase the growth and yields of crops.

Capability unit IVe-4

Only one mapping unit--Sandy alluvial fans--is in this capability unit. This soil is in the west-central part of the county. It is a deep fine sandy loam and, consists of sandy materials washed from the hills and deposited as alluvial fans at the bases of the slopes. The soil has moderately rapid permeability.

Because of the severe hazard of erosion, this soil is not suited to crops but should be used for range. Runoff water from higher areas has cut deep gullies into the sandy materials. If the areas are not protected, they will be eroded by wind.

Except that this soil is likely to be damaged by runoff from surrounding areas and is too unstable

for diversion terraces or ordinary terraces to hold, it can be used and managed the same as the soils in capability unit IVe-3.

Capability unit IVe-5

The soils in this capability unit are deep, hummocky or undulating, and moderately to rapidly permeable. They are extensive in the northwestern part of the county. More than three-fourths of the total acreage is tilled. The soils in this unit are:

Miles loamy fine sand, hummocky, eroded.
Springer loamy fine sandy, undulating.

Nearly all of the acreage is moderately to severely wind eroded. As a result, the topography is rough. The soils are better suited to small grains, sorghum almum, other sorghums, and summer and winter peas sowed broadcast than to other crops, but much cotton is grown. Yields are moderate to high.

Because of the hazard of erosion, these sandy soils are difficult to manage. Growing crops continuously that produce a large amount of residue and keeping the residue on the surface will control most of the wind erosion.

About the safest way to grow cotton and at the same time protect the soils from damage by wind is to plant the cotton in strips alternating with other crops. Plant 4 to 8 rows of cotton in strips alternating with 8 to 12 rows of sorghum or a small grain or other high residue-producing crops planted in strips of equal width. The strips should be run crosswise to the direction of the most damaging prevailing wind. Small grains, rye, or winter peas, planted in the cotton middles early in fall, will also effectively reduce damage from wind. Furthermore, if native vegetation is allowed to grow late in summer and in fall, the residues will give added protection against erosion by wind.

Sorghum almum or sorghums grown in alternate strips with the cotton should be cut at least 20 inches above the ground when it is harvested. The stubble should be left standing until after the blowing season is over.

In some places trees have been planted as windbreaks to protect the soils. The trees also provide excellent habitats for wildlife.

Applying moderate amounts of phosphate and nitrogen fertilizers will increase yields in most years. On a few farms, substantial increases in yields of wheat have been obtained when the wheat was planted following a crop of fertilized Austrian winter peas.

Capability unit IVw-1

Only one mapping unit--Spur soils--is in this capability unit. The Spur soils are deep, moderately permeable bottom-land soils. They are along Lake Creek. Some areas are flooded only occasionally, and others are flooded frequently. In some places floodwaters cause scouring.

The areas most frequently flooded are crossed by old stream channels but are well suited to pasture. The higher lying areas along the outer borders of the areas are flooded occasionally, but not so frequently as to prevent cultivation. The soils are moderately well suited to all of the crops commonly grown. They are better suited to crops that grow well in winter, however, than to other crops, because flooding seldom occurs in winter.

Capability unit VIe-1

The soils in this capability unit range from shallow to deep, and one soil is gravelly. The soils are gently sloping to sloping. They are droughty and are likely to be eroded by water. They are poorly suited to crops, and only about one-fourth of the acreage is tilled. The soils in this unit are:

Enterprise-Miles complex, 5 to 12 percent slopes.
Miles fine sandy loam, 5 to 8 percent slopes, eroded.
Wichita gravelly loam, 1 to 5 percent slopes.

Most areas of these soils that are tilled are included with soils that are better suited to agriculture or occur within large areas of better soils. If feasible, the areas should be seeded to a mixture of native grasses and returned to pasture.

These soils are in the range site, Mixed Land, Rolling Plains. Areas of the soils that are in pasture can be managed according to information given in the section "Range Management."

Capability unit VIe-2

Only one soil--Springer loamy fine sand, hummocky--is in this capability unit. This soil is deep and is rapidly permeable. Its rough, hummocky topography was caused by wind erosion that still continues. The soil is in the northwestern part of the county.

This soil is poorly suited to crops. The small acreage that is cultivated is badly eroded by wind and should be reseeded to grass. The soil is in the Sandy Land, Rolling Plains range site. Information about reseeding the soil to grass and managing it as grassland is given in the section "Range Management."

Capability unit VIe-3

The soils in this capability unit are very shallow and are gently sloping to sloping. The Vernon soil occurs throughout the county, but the Cottonwood soil is mainly in the southwestern part. The following soils are in this unit:

Cottonwood clay loam.
Vernon clay, 3 to 8 percent slopes.

Because of shallowness, droughtiness, and the risk of severe water erosion, these soils are not suited to cultivation. Their potential for producing grass is moderate. If they are well managed, moderate yields of forage are obtained. These soils are in range site, Shallow Hardlands, Rolling Plains. Management practices for range are discussed in the section "Range Management."

Capability unit VIe-4

Only one mapping unit--Alluvial land--is in this capability unit. The soil is deep, sandy, and rapidly permeable. It is in low-lying areas along the

Double Mountain Fork of the Brazos River. The areas are flooded periodically when the river overflows, and fresh sediments are deposited.

Because of the risk of flooding and deposition and the severe hazard of wind erosion, Alluvial land is not suited to crops. Good pastures can be established on it. In places the areas are subirrigated and produce a good stand of grass. Alluvial land is in the range site, Bottom Land, Rolling Plains. Management practices for range are discussed in the section "Range Management."

Capability unit VIs-1

The soils in this capability unit are shallow to very shallow, gently sloping to sloping, and stony. They are in the southeastern part of the county. The stones are fragments of limestone. The soils in this unit are:

Tarrant stony clay, 0 to 8 percent slopes.
Valera stony clay, 0 to 3 percent slopes.

If these soils are managed properly, an abundance of grass of high quality is obtained. The soils are in range site, Shallow Land, Rolling Plains-Limestone. Suitable management practices for range are discussed in the section "Range Management."

Capability unit VIIe-1

The soils in this capability unit are strongly sloping and are severely eroded. They occur throughout the county. The following soils are in this unit:

Rough broken land, sandy.
Rough broken land, clayey.
Vernon complex.

These soils are too sloping, too shallow, and too severely eroded for cultivation. They are poorly suited to range, and improving them is not practical. Much of the erosion is difficult to control. Spot seeding of suitable grasses on uneroded patches of soil and on stabilized bottom lands along the small gullies or streams is the only range improvement feasible.

Capability unit VIIs-1

Only one soil--Tarrant stony clay, 8 to 20 percent slopes--is in this capability unit. This is a very shallow, strongly sloping, stony soil. The stones are fragments of limestone. The soil is in the southeastern part of the county. It includes small, clifflike areas that have slopes of as much as about 80 percent.

This soil is too stony, shallow, and steep for crops. Its use for grazing is limited, and only a small amount of forage is produced. Most of the grass, however, is of good quality.

Improving this soil is not practical, and grazing must be managed carefully. The soil is in range site, Rocky Hills, Rolling Plains-Limestone. Information about management is given in the section "Range Management."

Estimated Yields

In this section are given estimated average acre yields for the soils of the county farmed without irrigation and for a few of the soils farmed under irrigation. The estimates are based partly on information obtained from interviews with local farmers and agricultural workers. They are also based on the results of tests conducted by the Texas Agricultural Experiment Station.

Table 2 gives estimated average acre yields, under two levels of management, for crops grown without irrigation. It also gives estimated average acre yields of crops grown on a few of the soils under irrigation. The estimates show the average yields that can be expected over a number of years.

TABLE 2.--*Estimated average acre yields of principal crops to be expected without irrigation and with irrigation*

[Dashes indicate the crop is seldom grown on the soil indicated or that the soil is not suited to it]

Soil	Cotton (lint)			Grain sorghum			Forage sorghum		Wheat		
	A	B	C	A	B	C	A	B	A	B	C
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Tons*	*Tons (dry)*	*Bushels*	*Bushels*	*Bushels*
Abilene clay loam, 0 to 1 percent slopes	175	195	1,000	800	900	3,500	1 3/4	2	12	16	45
Abilene clay loam, 1 to 3 percent slopes	140	170	-------	700	800	-------	1 1/2	1 3/4	10	14	-------
Abilene clay loam, 1 to 3 percent slopes, eroded	125	170	-------	650	800	-------	1 1/4	1 3/4	9	14	-------
Abilene loam, 0 to 1 percent slopes	190	210	1,000	800	900	4,000	1 3/4	2	12	16	45
Abilene loam, 1 to 3 percent slopes	150	180	-------	750	850	-------	1 1/2	1 3/4	10	14	-------
Abilene-Miles complex	220	240	900	850	925	4,000	1 3/4	2	14	17	30
Alluvial land	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Altus loamy fine sand	225	250	900	1,000	1,100	3,600	1 1/2	1 3/4	10	14	40
Byrds clay, 0 to 1 percent slopes	150	165	-------	800	875	-------	1 1/2	1 3/4	12	16	-------
Byrds clay, 1 to 3 percent slopes	130	150	-------	750	850	-------	1	1 1/2	10	14	-------
Byrds clay, shallow, 0 to 3 percent slopes	90	100	-------	600	650	-------	3/4	1	8	10	-------
Cottonwood clay loam	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Drake clay loam, 1 to 3 percent slopes	90	100	-------	600	650	-------	3/4	1	8	10	-------
Enterprise fine sandy loam, 1 to 3 percent slopes	165	195	-------	850	950	-------	1 1/2	1 3/4	12	14	-------
Enterprise fine sandy loam, 1 to 5 percent slopes, eroded	60	-------	-------	700	900	-------	1	1 1/4	8	13	-------
Enterprise-Miles complex, 5 to 12 percent slopes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Foard clay loam, 0 to 1 percent slopes	110	125	-------	700	775	-------	1 1/4	1 1/2	12	15	-------
Foard clay loam, 1 to 3 percent slopes	90	110	-------	650	700	-------	1	1 1/4	9	12	-------
Foard clay loam, 1 to 3 percent slopes, eroded	80	110	-------	600	700	-------	3/4	1 1/4	8	12	-------
Hollister clay loam, 0 to 1 percent slopes	175	195	-------	800	900	-------	1 3/4	2	12	16	-------
Hollister clay loam, 1 to 3 percent slopes	140	170	-------	750	900	-------	1 1/2	1 3/4	10	14	-------
Mansker clay loam, 0 to 3 percent slopes	90	100	-------	600	650	-------	3/4	1	8	10	-------
Mansker clay loam, 1 to 5 percent slopes, eroded	75	-------	-------	500	600	-------	1/2	3/4	5	8	-------
Miles loamy fine sand, undulating	225	250	900	1,000	1,100	3,600	1 1/4	1 1/2	10	14	40
Miles loamy fine sand, hummocky, eroded	200	220	750	900	1,000	2,800	1	1 1/2	8	12	-------
Miles fine sandy loam, 0 to 1 percent slopes	200	220	1,000	900	1,000	4,000	1 3/4	2	12	16	45
Miles fine sandy loam, 1 to 3 percent slopes	175	210	-------	800	950	-------	1 1/2	1 3/4	10	14	-------
Miles fine sandy loam, 1 to 3 percent slopes, eroded	160	190	-------	750	950	-------	1 1/4	1 3/4	9	14	-------
Miles fine sandy loam, 3 to 5 percent slopes, eroded	75	-------	-------	500	750	-------	1/2	3/4	7	10	-------
Miles fine sandy loam, 5 to 8 percent slopes, eroded	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Miles fine sandy loam, undulating	200	220	800	900	1,000	3,800	1 3/4	2	12	16	40
Miles fine sandy loam, undulating, eroded	180	200	750	800	1,000	-------	1 1/2	1 3/4	10	16	-------

TABLE 2.--*Estimated average acre yields of principal crops to be expected without irrigation and with irrigation*--Continued

Soil	Cotton (lint)			Grain sorghum			Forage sorghum		Wheat		
	A	B	C	A	B	C	A	B	A	B	C
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Tons*	*Tons (dry)*	*Bushels*	*Bushels*	*Bushels*
Miller silty clay loam	150	175	-------	800	1,000	-------	1 1/2	2	10	16	-------
Miller clay	130	150	-------	700	900	-------	1 1/2	2	10	15	-------
Norwood silty clay loam	160	185	-------	850	1,050	-------	1 1/2	2	10	16	-------
Owens clay, 1 to 3 percent slopes	-------	100	-------	600	650	-------	1	1 1/4	9	12	-------
Portales fine sandy loam, 0 to 1 percent slopes	180	200	800	700	850	3,800	1 1/2	1 3/4	10	14	-------
Portales clay loam, 0 to 1 percent slopes	175	195	750	800	900	3,600	1 1/2	1 3/4	10	14	-------
Randall clay	160	175	-------	700	850	-------	1 3/4	2 1/4	8	12	-------
Roscoe clay, 0 to 1 percent slopes	165	180	-------	800	900	-------	1 3/4	2	12	16	-------
Roscoe clay, 1 to 3 percent slopes	150	175	900	700	800	-------	1 1/2	1 3/4	10	14	-------
Rough broken land, sandy	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Rough broken land, clayey	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Sandy alluvial fans	80	-------	-------	700	750	-------	3/4	1	8	10	-------
Springer loamy fine sand, undulating	180	200	800	900	1,000	3,400	1	1 1/4	10	14	-------
Springer loamy fine sand, hummocky	70	-------	-------	500	-------	-------	-------	-------	-------	-------	-------
Springer-Altus loamy fine sands	200	220	900	1,000	1,100	3,600	1 1/2	1 3/4	10	14	-------
Spur soils	175	195	-------	800	900	-------	1 1/2	1 3/4	12	16	-------
Stamford clay, 1 to 3 percent slopes	80	95	-------	550	650	-------	3/4	1	7	10	-------
Stamford clay, 3 to 5 percent slopes	-------	-------	-------	-------	-------	-------	1/2	3/4	6	8	-------
Stamford clay, 3 to 5 percent slopes, eroded	-------	-------	-------	-------	-------	-------	1/4	3/4	5	8	-------
Tarrant stony clay, 0 to 8 percent slopes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Tarrant stony clay, 8 to 20 percent slopes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Tillman clay loam, 0 to 1 percent slopes	110	125	-------	700	775	-------	1 1/4	1 1/2	12	15	-------
Tillman clay loam, 1 to 3 percent slopes	90	110	-------	650	700	-------	1	1 1/4	9	12	-------
Tillman clay loam, 1 to 3 percent slopes, eroded	75	110	-------	600	700	-------	3/4	1 1/4	8	12	-------
Tillman clay loam, 3 to 5 percent slopes	60	-------	-------	-------	-------	-------	-------	-------	6	9	-------
Tillman clay loam, shallow, 0 to 3 percent slopes	80	90	-------	400	450	-------	3/4	1	8	10	-------
Tillman clay loam, shallow, 3 to 5 percent slopes	50	-------	-------	-------	-------	-------	-------	-------	7	9	-------
Tillman clay loam, shallow, 1 to 5 percent slopes, eroded	-------	-------	-------	-------	-------	-------	-------	-------	6	9	-------
Tillman-Foard complex, 0 to 1 percent slopes	100	110	-------	600	650	-------	1	1 1/4	12	14	-------
Tipton loam, 0 to 1 percent slopes	225	250	-------	900	1,000	-------	1 3/4	2	12	16	-------
Valera clay, 0 to 1 percent slopes	175	200	-------	800	900	-------	1 3/4	2	12	16	-------
Valera clay, 1 to 3 percent slopes	140	170	-------	700	800	-------	1 1/2	1 3/4	10	14	-------
Valera clay, shallow, 0 to 3 percent slopes	90	100	-------	600	650	-------	3/4	1	8	10	-------
Valera stony clay, 0 to 3 percent slopes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Vernon clay, 3 to 8 percent slopes	60	-------	-------	500	-------	-------	-------	-------	5	-------	-------
Vernon complex	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Wichita clay loam, 0 to 1 percent slopes	175	195	-------	850	950	-------	1 3/4	2	12	16	-------
Wichita clay loam, 1 to 3 percent slopes	140	170	-------	750	900	-------	1 1/2	1 3/4	10	14	-------
Wichita clay loam, 1 to 3 percent slopes, eroded	125	170	-------	700	900	-------	1 1/4	1 3/4	9	14	-------
Wichita gravelly loam, 1 to 5 percent slopes	60	-------	-------	300	-------	-------	1/2	-------	6	-------	-------
Yahola fine sandy loam	130	145	-------	-------	-------	-------	-------	-------	-------	-------	-------

In columns A are yields to be expected without irrigation under management commonly used. With this type of management, terracing and contour farming are practiced to some extent on nearly all of the farms and some crop residues are used. The practices are not combined or used properly to conserve the soil and to obtain high yields.

In columns B are yields to be expected without irrigation if improved management is used. Improved management consists of planting crops that will improve the soil, seeding improved varieties, using crop residues, practicing contour farming and terracing on suitable soils, applying moderate amounts of fertilizer where needed, and using other good management practices. These practices are discussed in the subsection "General Management Practices."

Columns C give estimated average acre yields of crops to be expected on soils that are irrigated. Only a few yields are shown in this column because only a few of the soils are irrigated.

Range Management [1]

Approximately 39 percent of Haskell County is grassland, used for ranching operations. The county is mainly in the Rolling Plains. Most of it is underlain by red beds or limestone, but there are some sandy areas. Soils formed in clayey materials derived from the red beds normally support short and mid grasses. On the sandy areas tall grasses are dominant when the range is in excellent condition. The soils in the southeastern part of the county, formed in materials from limestone, have better soil-air-moisture relationships than soils formed in material from the red beds. Consequently, mid and tall grasses grow well on these soils.

On most of the ranches, grazing of the grasslands is combined with supplemental grazing of winter small grains to obtain a balanced year-round livestock program. Concentrates are also used as supplemental feed in winter and at other times when the supply of forage is low. Some ranchers creep feed the yearling calves to increase their weight and to improve the quality of the meat.

Because for several decades the ranges of the county have been used for grazing cattle, the native vegetation has been depleted. Grasslands that were once open are now infested with brush. The amount of forage on much of the range has been reduced to less than half of that originally produced. Various mechanical methods are now used to help control brush and to revegetate the range. Using these methods and other good management practices based on the potential yield of the soils will help to restore the native grassland to its original productivity.

Principles of range management

Improving the native vegetation on the range will increase the amount of forage produced and will help to conserve soil and water. To improve the vegetation, manage grazing so as to encourage the best native forage plants.

Successive, although overlapping, stages in the growth of grass are the growth of leaves, the growth of roots, formation of the flower stalks, production of seed, regrowth of forage, and storage of food in

[1] Information for this section supplied by Joe Norris, range specialist, Soil Conservation Service.

the roots. Grazing must allow for these natural processes of growth if high yields of forage and consequent gains in weight or in numbers of animals are to be obtained.

Livestock graze selectively and seek out the more palatable and nutritious plants. If grazing is not regulated, the better plants are weakened and less desirable plants increase. If grazing pressure continues, the better plants are eliminated and the second-choice plants are thinned out. Then, undesirable weeds take their place or the soil is left bare. Range that is in poor condition because it has been severely overgrazed improves slowly unless mechanical practices are used along with other improved management to control brush, prepare the seedbed, and reseed the areas.

Experience by stockmen and studies by research workers have shown that if only about half of the yearly volume of grass produced is grazed, damage to the more desirable plants is minimized and the range can improve so that it will produce the maximum amount of forage. The grass left on the range helps reduce extremes of temperature in the surface soil throughout the year. It also serves as a mulch that encourages the rapid intake of water. The more water stored in the soil, the better the growth of plants for grazing.

Roots of grass that has not been overgrazed grow so they can reach the moisture deep in the soil; the roots of grass that has been overgrazed cannot reach deep into the soil because not enough green shoots have been left to provide the food needed for good root growth.

If grasses are vigorous, the better grasses can crowd out weeds, which means that ranges that are low in productivity will improve. Plants that have plenty of topgrowth are able to store food so that they will make quick and vigorous growth in spring and after periods of drought. Plenty of grass provides a reserve of feed for the dry spells that otherwise might make necessary the sale of livestock at a loss. A good cover of grass is also one of the best means of preventing erosion by wind and water.

Good range management requires that grazing be adjusted from season to season to match the amount of forage produced. The range operator needs to provide reserve pastures or other feed for use during periods of drought or at other times when the production of forage has been curtailed. This permits moderate grazing of the forage at all times. Besides having a reserve of forage and feed, the operator may want to keep some readily salable stock, such as stocker steers. Such flexibility allows the rancher to balance the number of livestock he keeps on hand with the production of forage without sacrificing breeding animals.

Range sites and condition classes

To make use of the best management practices and thus improve his grassland, the range operator needs to know the kinds of range plants that are native to his area and the combinations in which they grow. He should be able to read the signs that show him whether his range is getting better or worse. Important changes in the kinds of grasses often take place gradually. They can be overlooked by an operator who is not acquainted with his range plants and his soils. Sometimes the extra growth of plants resulting from favorable rainfall causes the operator to conclude that the range is improving, when actually the longtime trend is toward poorer grasses and lower production. On the other hand, temporary close grazing that gives range the appearance of being in poor condition may provide only a temporary setback to healthy grass in the care of a capable manager.

Different kinds and amounts of grass are produced on different kinds of soil. Therefore, to manage the range properly, the operator needs to know the different kinds of soil in his holdings and the plants each kind is capable of growing. He will then be able to manage the range so as to favor the best forage plants on each kind of soil.

Range sites are kinds of rangeland that differ from each other in their ability to produce a significantly different kind or amount of climax, or original, vegetation. A significant difference means one great enough to require different grazing use or management.

Table 3 lists the soils of Haskell County according to range sites. It also names the grasses that grow on the particular site when it is in climax condition and gives the estimated amount of forage to be expected on each site. This information will be useful in planning a program to improve the range.

Climax vegetation is the combination of plants that grew originally on a given site. The most productive combination of forage plants on rangeland is generally the climax type of vegetation.

Range condition is the present condition of the vegetation in relation to the climax condition for the site. Four condition classes have been defined. A range in excellent condition has from 76 to 100 percent of the vegetation characteristic of the climax vegetation on the same site; one in good condition, 51 to 75 percent; one in fair condition, 26 to 50 percent; and one in poor condition, less than 25 percent.

Ranchers want a range to be in excellent or good condition because such a range yields the most forage and provides the most cover that will help conserve soil and water. Knowledge of the range site and range condition class helps a rancher tell how good his range is and how much better it can become under correct use. An inventory of range site and condition of the range thus gives the operator an evaluation of his range that will help him determine what can be done to maintain or improve it.

Practices for rangeland

Practices to improve the rangeland should be based on specific range sites and conditions. The practices most applicable to rangelands in Haskell County are proper use of the range, deferred grazing, control of brush and weeds, and seeding of native grasses.

Proper range use means grazing the rangelands in such a way that enough plants are left to protect the soil and conserve water. It also means that the

TABLE 3.--*The soils arranged by range site, grasses that grow on the site when it is in climax condition, and the estimated amount of forage produced annually*

ROLLING PLAINS

Range site and soil	Dominant grasses	Amount of forage (dry weight)
		Pounds
Bottom Land:		
Alluvial land.	Indiangrass, sand bluestem, switchgrass, little bluestem, side-oats grama, Canada wildrye, Texas wintergrass, (Stipa leucotricha), and western wheatgrass.	1,200 to 1,500.
Miller clay.		
Miller silty clay loam.		
Norwood silty clay loam.		
Sandy alluvial fans.		
Spur soils.		
Yahola fine sandy loam.		
Deep Hardlands:		
Abilene clay loam, 0 to 1 percent slopes.	Blue grama, side-oats grama, vine-mesquite, western wheatgrass, white tridens, buffalograss, and tobosagrass.	600 to 1,000.
Abilene clay loam, 1 to 3 percent slopes.		
Abilene clay loam, 1 to 3 percent slopes, eroded.		
Abilene loam, 0 to 1 percent slopes.		
Abilene loam, 1 to 3 percent slopes.		
Foard clay loam, 0 to 1 percent slopes.		
Foard clay loam, 1 to 3 percent slopes.		
Foard clay loam, 1 to 3 percent slopes, eroded.		
Hollister clay loam, 0 to 1 percent slopes.		
Hollister clay loam, 1 to 3 percent slopes.		
Owens clay, 1 to 3 percent slopes.		
Portales clay loam, 0 to 1 percent slopes.		
Randall clay.		
Roscoe clay, 0 to 1 percent slopes.		
Roscoe clay, 1 to 3 percent slopes.		
Stamford clay, 1 to 3 percent slopes.		
Stamford clay, 3 to 5 percent slopes.		
Stamford clay, 3 to 5 percent slopes, eroded.		
Tillman clay loam, 0 to 1 percent slopes.		
Tillman clay loam, 1 to 3 percent slopes.		
Tillman clay loam, 1 to 3 percent slopes, eroded.		
Tillman clay loam, 3 to 5 percent slopes.		
Tillman-Foard complex, 0 to 1 percent slopes.		
Wichita clay loam, 0 to 1 percent slopes.		
Wichita clay loam, 1 to 3 percent slopes.		
Wichita clay loam, 1 to 3 percent slopes, eroded.		
Shallow Hardlands:		
Cottonwood clay loam.	Blue grama, side-oats grama, buffalograss, and tobosagrass.	400 to 800.
Mansker clay loam, 0 to 3 percent slopes.		
Mansker clay loam, 1 to 5 percent slopes, eroded.		
Tillman clay loam, shallow, 0 to 3 percent slopes.		
Tillman clay loam, shallow, 3 to 5 percent slopes.		
Tillman clay loam, shallow, 1 to 5 percent slopes, eroded.		
Vernon clay, 3 to 8 percent slopes.		
Mixed Land:		
Abilene-Miles complex.	Little bluestem, blue grama, side-oats grama, plains bristlegrass, Arizona cottontop, and buffalograss.	900 to 1,300.
Drake clay loam, 1 to 3 percent slopes.		
Enterprise fine sandy loam, 1 to 3 percent slopes.		
Enterprise fine sandy loam, 1 to 5 percent slopes, eroded.		
Enterprise-Miles complex, 5 to 12 percent slopes.		

ROLLING PLAINS--Continued

Range site and soil	Dominant grasses	Amount of forage (dry weight)
		Pounds
Mixed Land--Continued		
Miles fine sandy loam, 0 to 1 percent slopes.		
Miles fine sandy loam, 1 to 3 percent slopes.		
Miles fine sandy loam, 1 to 3 percent slopes, eroded.		
Miles fine sandy loam, 3 to 5 percent slopes, eroded.		
Miles fine sandy loam, 5 to 8 percent slopes, eroded.		
Miles fine sandy loam, undulating.		
Miles fine sandy loam, undulating, eroded.		
Portales fine sandy loam, 0 to 1 percent slopes.		
Tipton loam, 0 to 1 percent slopes.		
Wichita gravelly loam, 1 to 5 percent slopes.		
Sandy Land:		
Altus loamy fine sand.	Indiangrass, sand bluestem, switchgrass, sand lovegrass, side-oats grama, giant dropseed, hairy grama, and Texas bluegrass.	500 to 900.
Miles loamy fine sand, undulating.		
Miles loamy fine sand, hummocky, eroded.		
Springer loamy fine sand, undulating.		
Springer loamy fine sand, hummocky.		
Springer-Altus loamy fine sands.		
Rough Breaks:		
Rough broken land, sandy.	Side-oats grama, blue grama, buffalograss, and tobosagrass.	400 to 800.
Rough broken land, clayey.		
Vernon complex.		

ROLLING PLAINS-LIMESTONE

Range site and soil	Dominant grasses	Amount of forage (dry weight)
Bottom Land:		
Norwood silty clay loam.	Sand bluestem, Indiangrass, switchgrass, little bluestem, Canada wildrye, side-oats grama, vine-mesquite, and Texas wintergrass.	1,300 to 1,600.
Deep Hardlands:		
Byrds clay, 0 to 1 percent slopes.	Side-oats grama, blue grama, vine-mesquite, white tridens, and buffalograss.	800 to 1,200.
Byrds clay, 1 to 3 percent slopes.		
Valera clay, 0 to 1 percent slopes.		
Valera clay, 1 to 3 percent slopes.		
Shallow Land:		
Byrds clay, shallow, 0 to 3 percent slopes.	Side-oats grama, little bluestem, tall dropseed, Texas wintergrass, and buffalograss.	800 to 1,200.
Tarrant stony clay, 0 to 8 percent slopes.		
Valera clay, shallow, 0 to 3 percent slopes.		
Valera stony clay, 0 to 3 percent slopes.		
Rocky Hills:		
Tarrant stony clay, 8 to 20 percent slopes.	Indiangrass, switchgrass, sand bluestem, green sprangletop, tall dropseed, and Texas wintergrass.	700 to 1,000.

quality of the vegetation will be maintained or improved. Proper use of the range is needed on all rangelands, even though the range is in excellent condition. Without this practice, all other practices will fail.

Deferred grazing consists of resting a range from grazing for a time during the growing season. As a result, the vigor of the plants improves and the better plants can produce seed. Besides helping to improve the range, deferred grazing builds up a reserve of forage for later use.

Another system of deferred grazing consists of resting one or more units of the range at planned intervals during the growing season so that year after year each range is rested during a different season than in the previous year. This permits all of the better forage plants to develop fully and to produce seed every second, third, or fourth year. A range unit may need to be deferred in successive years if it is severely deteriorated.

Control of brush and weeds is necessary if the cover of grass is to be improved within a reasonable length of time. Mechanical or chemical treatment (fig. 9) can be used in many areas. Controlling brush and weeds releases needed moisture for use by the remaining, more desirable plants, permitting them to mature and reseed. Removing brushy vegetation also makes it easier to control livestock and lowers operating costs.

Range seeding consists of establishing perennial or improved grasses on native ranges to prevent losses of soil and water; it also restores ranges in poor condition and soils converted to range from other uses. After the seedbed has been prepared,

Figure 9.—Control of mesquite by use of a chemical spray. In the upper picture a thick stand of mesquite shades the grass and uses moisture needed by the grass; in the lower picture the area is shown 4 months after it was sprayed.

the seed is broadcast or drilled using drills that have been adapted for use in seeding grasses. Using pitting or chiseling equipment to prepare the seedbed also helps to stimulate the growth of desirable plants by increasing the intake of water for short periods.

Another method used in seeding old fields to perennial grasses consists of growing a high-residue producing crop prior to seeding the grass. This crop should not be allowed to mature seed. The following year, the desired grasses are drilled in the undisturbed cover. The undisturbed cover provides a mulch, which retains moisture near the surface of the soil, keeps the temperature of the soil down, and helps to prevent surface crusting.

Other practices that will help in managing the range include salting, supplemental feeding, providing water, and fencing the range.

Salting can be used to improve the distribution of grazing and to get more uniform use of the range. Normally, salt needs to be located away from water, roads, or other areas that are traveled frequently. The livestock will then be drawn into areas that, because of lack of water, rough topography, or odd shape, would otherwise be grazed infrequently.

Supplemental feed supplied in winter or at other times when the supply of forage is low, should be placed away from water or salting areas. As with salting, supplemental feeding should be progressive. The feed should be placed so that livestock will not concentrate and trample one area excessively, thus damaging the vegetation beyond the point of quick response to management.

Supplies of water should be located at various points over the entire range so that the range will be used evenly. Wells, ponds, developed springs, and pipelines can be used to provide water (fig. 10). In some places water needs to be hauled in. The kind of range will determine the type of water supply that will be the most practical.

A suitable fence placed around a range helps to maintain the quality of livestock and to keep the range in good condition. It separates the various classes of stock, and separate range units are provided for seasonal use. In some places sites are separated by fences if the differences between the quality of the ranges are great or the areas are too large.

Thought and planning are required to determine the kind and condition of a range site and the treatment needed. To provide a practical plan for range improvement that is technically sound and economically feasible, the rancher can consult the local representative of the Soil Conservation Service, the county agricultural agent, or members of the staff of the Texas Agricultural Experiment Station.

Engineering Uses of Soils[2]

This section presents in tabular form information about the engineering properties of soils. It can be used by engineers in planning but is not a substitute for detailed sampling and testing at the site where engineering structures are to be designed and constructed. The mapping and descriptive reports are somewhat generalized and should be used only in planning more detailed field surveys to determine the in-place condition of the soil at the site of the proposed engineering construction. Nevertheless, the information in the report can be used in planning or locating sites for structures; for

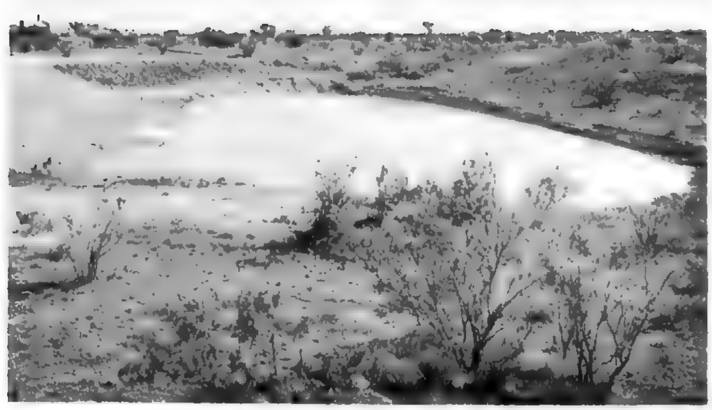

Figure 10.—Dam across a small stream impounds water for livestock; it also provides a good place for fish.

[2] By Roy D. Thompson, Jr., engineer, Soil Conservation Service.

Map symbol	Soil name	Brief description of soil[1]	Depth from surface	Classification: USDA Texture	Classification: Unified	Classification: AASHO
			Inches			
AcA AcB AcB2	Abilene clay loam, 0 to 1 percent slopes. Abilene clay loam, 1 to 3 percent slopes. Abilene clay loam, 1 to 3 percent slopes, eroded.	Inorganic clays of medium to high plasticity; developed from old alluvium or outwash materials of Tertiary and Quaternary age.	0 to 5	Clay loam	CL-CH	A-7
			5 to 11	Clay loam	CL-CH	A-7
			11 to 19	Loam, clay loam, or silty clay loam.	CL-CH	A-7
			19 to 33	Clay loam to silty clay	CL-CH	A-7
			33 to 52	Clay	CL	A-6 to A-7
			52 to 72	Clay loam, clay, or silt loam	CL	A-6 to A-7
AdA AdB Ae	Abilene loam, 0 to 1 percent slopes. Abilene loam, 1 to 3 percent slopes. Abilene-Miles complex.	Inorganic sandy clay over clay of medium to high plasticity; developed in outwash material of Quaternary age.	0 to 12	Loam to fine sandy loam	ML	A-4
			12 to 20	Clay to sandy clay loam	CL	A-6
			20 to 34	Clay	CL	A-6, A-7
			34 to 46	Clay	CL	A-6, A-7
			46 to 58	Clay	CL	A-6, A-7
			58 to 76	Clay	CL	A-6, A-7
Al	Alluvial land.	Mixture of gravel, sand, and silt; stratified; numerous pebbles; composed of outwash from the Yahola, Norwood, and Miller soils; subject to occasional flooding.	0 to 72+	Fine sandy loam and loamy fine sand.	GM-SM	A-2, A-4
At	Altus loamy fine sand.	Silty sand to sandy clay that contains inorganic clay soil binder of low to medium plasticity; topography is generally level to slightly concave.	0 to 18	Loamy fine sand	SM	A-2, A-4
			18 to 26	Fine sandy loam	SC or SM	A-2, A-6
			26 to 42	Clay	CL	A-6, A-7
			42 to 60	Sandy clay loam	CL	A-4, A-6
BcA BcB ByB	Byrds clay, 0 to 1 percent slopes. Byrds clay, 1 to 3 percent slopes. Byrds clay, shallow, 0 to 3 percent slopes.	Inorganic clay to a depth of approximately 16 to 21 inches over fragments of broken limestone; limestone bedrock at a depth of 21 inches; topography is generally level to gently sloping.	0 to 16	Clay	CL	A-7
			16 to 21	Clay	CL	A-7
			21+	Limestone.		
Cc	Cottonwood clay loam.	Inorganic clay loam of low plasticity developed from underlying gypsum beds.	0 to 5	Clay loam	ML	A-4, A-5
			5 to 20	Silty clay loam	ML	A-4, A-5
			20+	Gypsum rock	(²)	(²)
DrB	Drake clay loam, 1 to 3 percent slopes.	Clayey sand or a mixture of sand and clay of low to medium plasticity; eolian in origin.	0 to 14	Sandy clay loam	ML or CL	A-4, A-6
			14 to 34	Clay loam	CL	A-4, A-5
			34 to 54	Clay loam	CL	A-4, A-5
EnB EnC2	Enterprise fine sandy loam, 1 to 3 percent slopes. Enterprise fine sandy loam, 1 to 5 percent slopes, eroded.	Fine sandy loam material that is granular and porous; alluvial in origin.	0 to 22	Fine sandy loam	SM-ML	A-2, A-4
			22 to 48	Fine sandy loam	SM-ML	A-2, A-4
EpD	Enterprise-Miles complex, 5 to 12 percent slopes.	About 75 percent of this mapping unit is gravelly and is composed of 45 percent Miles fine sandy loam, 35 percent Enterprise fine sandy loam, and 15 percent Vernon soils.	Not mapped in detail.	See Enterprise and Miles soils.		
FcA FcB FcB2	Foard clay loam, 0 to 1 percent slopes. Foard clay loam, 1 to 3 percent slopes. Foard clay loam, 1 to 3 percent slopes, eroded.	Inorganic silty clay and clay of medium to high plasticity developed in material from the Permian red beds.	0 to 6	Silty clay loam	CL	A-7
			6 to 26	Clay	CL-CH	A-7
			26 to 38	Clay	CL-CH	A-7
			38 to 50	Clay	CL-CH	A-7
			50 to 60	Clay	CL	A-7
HoA HoB	Hollister clay loam, 0 to 1 percent slopes. Hollister clay loam, 1 to 3 percent slopes.	Inorganic clays and silty clays of medium to high plasticity developed in material from the Permian red beds.	0 to 4	Silty clay loam	CL,CL-CH,ML	A-6, A-7
			4 to 8	Silty clay loam	CL,CL-CH,ML	A-6, A-7
			8 to 14	Silty clay loam	CL,CL-CH,ML	A-6, A-7
			14 to 32	Clay, silt loam, or silty clay loam.	CH,CL-CH	A-7
			32 to 52	Clay	CL-CH	A-7-6
			52 to 72	Clay, clay loam, or silty clay loam.	CL,CL-CH	A-7
MaB MaC2	Mansker clay loam, 0 to 3 percent slopes. Mansker clay loam, 1 to 5 percent slopes, eroded.	Inorganic silty clay of medium to high plasticity; developed over Seymour deposits; has an excess of calcium carbonate at depths between 18 and 40 inches.	0 to 4	Loam to silty clay loam	CL-CH	A-7
			4 to 10	Clay loam	CL-CH	A-7
			10 to 18	Clay loam	CL-CH	A-7
			18 to 40	Silty clay loam	CL-CH	A-7
			40 to 50	Clay	CL	A-6, A-7
Mk Mh2	Miles loamy fine sand, undulating. Miles loamy fine sand, hummocky, eroded.	Silty sand or a mixture of sand and silt of low plasticity; generally level, but there are occasional shallow depressions or hummocks; complex slopes.	0 to 14	Loamy fine sand	SM	A-2, A-4
			14 to 20	Fine sandy loam	SM-ML	A-2, A-6
			20 to 38	Sandy clay	CL	A-4
			38 to 60	Fine sandy loam	SC-CL	A-2, A-6
MfA MfB MfB2 MfC2 MfD2 Md Md2	Miles fine sandy loam, 0 to 1 percent slopes. Miles fine sandy loam, 1 to 3 percent slopes. Miles fine sandy loam, 1 to 3 percent slopes, eroded. Miles fine sandy loam, 3 to 5 percent slopes, eroded. Miles fine sandy loam, 5 to 8 percent slopes, eroded. Miles fine sandy loam, undulating. Miles fine sandy loam, undulating, eroded.	Silty sand or a mixture of sand and silt of low plasticity; developed from outwash material of Quaternary age; gently sloping to undulating; complex slopes.	0 to 8	Fine sandy loam	SM	A-2, A-4
			8 to 15	Fine sandy loam	SC-SM	A-4, A-6
			15 to 39	Fine sandy loam to sandy clay loam.	SC-CL	A-6
			39 to 72	Fine sandy loam	SC	A-2, A-6

See footnotes at end of table.

County, Tex., and their estimated physical properties

Percentage passing--			Permeability	Structure	Available water capacity	Reaction	Salinity	Dispersion	Shrink-swell potential	Gypsum content
No. 200 sieve	No. 10 sieve	No. 4 sieve								
			Inches per hour		*Inches per foot of soil*	*pH*				
80 to 95	100	100	0.20 to 0.50	Granular	1.6 to 2.5	6.5 to 7.5	Low to moderate	Low to moderate	High	Low.
80 to 95	100	100	0.20 to 0.50	Subangular blocky	1.6 to 2.5	6.5 to 7.5	Low to moderate	Low to moderate	High	Low.
80 to 95	100	100	0.20 to 0.50	Subangular blocky	1.6 to 2.5	7.5 to 8.5	Moderate	Moderate	High	Low.
80 to 95	100	100	0.05 to 0.20	Blocky	1.6 to 2.5	7.0 to 8.5	Moderate	Moderate	High	Low.
75 to 80	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	7.0 to 8.5	Moderate	Moderate	High	Low.
75 to 80	95 to 100	100	0.20 to 0.50	Massive	1.6 to 2.5	7.0 to 8.5	Moderate	Moderate	High	Low.
50 to 75	100	100	0.80 to 2.50	Granular	1.5 to 2.4	7.5 to 8.0	Low	Low	Low	Low.
50 to 75	100	100	0.50 to 0.80	Subangular blocky	1.6 to 2.5	7.5 to 8.0	Low	Low	Low to moderate	Low.
80 to 95	100	100	0.20 to 0.50	Subangular blocky	2.2 to 2.5	6.5 to 7.5	Low	Moderate to high	High	Low.
80 to 95	100	100	0.20 to 0.50	Blocky	2.2 to 2.5	8.0 to 8.5	Low	Moderate to high	High	Low.
80 to 95	100	100	0.20 to 0.50	Blocky	2.2 to 2.5	8.0 to 8.5	Low	Moderate to high	High	Low.
80 to 95	100	100	0.20 to 0.50	Massive	2.2 to 2.5	6.5 to 7.0	Low	Moderate to high	High	Low.
25 to 40	85 to 90	90 to 95	0.80 to 2.50	Granular	1.5 to 2.4	7.5 to 8.0	Low to high	Low to moderate	Low	Low.
25 to 50	95 to 100	100	0.8 to 2.50	Structureless	1.0 to 1.5	6.5 to 7.5	Low	Low	Low	Low.
30 to 50	90 to 100	100	0.8 to 2.50	Prismatic	1.5 to 2.4	6.5 to 7.5	Low	Low	Low	Low.
80 to 95	100	100	0.05 to 0.20	Subangular blocky	2.2 to 2.5	6.5 to 7.5	Moderate	Moderate to high	Moderate	Low.
70 to 80	95 to 100	100	0.5 to 0.8	Subangular blocky	1.5 to 2.4	6.5 to 7.5	Low	Moderate to high	Moderate	Low.
80 to 95	100	100	0.05 to 0.20	Prismatic to subangular blocky.	2.2 to 2.5	6.0 to 6.5	Low	High	High	Low.
80 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	6.0 to 6.5	Low	High	High	Low.
80 to 90	100	100	0.2 to 0.50	Granular	1.6 to 2.5	8.0 to 8.5	Moderate	High	High	High.
80 to 95	100	100	0.2 to 0.50	Granular	1.6 to 2.5	8.0 to 8.5	Moderate to high	High	High	High.
([2])	([2])	([2])	([2])	([2])	([2])	([2])	([2])	([2])	([2])	High.
60 to 85	95 to 100	100	0.20 to 0.50	Granular	1.5 to 2.4	8.0 to 8.5	Low to moderate	Low	Moderate to high	Low.
80 to 95	95 to 100	100	0.20 to 0.50	Blocky	1.6 to 2.5	8.0 to 8.5	Low to moderate	Moderate	Moderate to high	Low.
80 to 95	95 to 100	100	0.20 to 0.50	Blocky	1.6 to 2.5	8.0 to 8.5	Low to moderate	Moderate	Moderate to high	Low.
30 to 60	100	100	0.80 to 2.50	Granular	1.5 to 2.4	6.5 to 7.5	Low	Low	Low	Low.
30 to 60	100	100	0.80 to 2.50	Granular	1.5 to 2.4	8.0 to 10.0	Low	Low	Low	Low.
85 to 95	100	100	0.20 to 0.50	Blocky	1.6 to 2.5	6.5 to 7.5	Low	Moderate	High	Low.
90 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	6.5 to 7.5	Low	High	High	Low.
90 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	6.5 to 7.5	Low	High	High	Low.
90 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	7.5 to 8.0	Low	High	High	Low.
90 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	8.0 to 9.0	Low	High	High	Low.
85 to 90	100	100	0.20 to 0.50	Granular	1.6 to 2.5	6.5 to 7.5	Low	Moderate	High	Low.
85 to 90	100	100	0.20 to 0.50	Granular	1.6 to 2.5	6.5 to 7.5	Low	Moderate	High	Low.
85 to 90	100	100	0.20 to 0.50	Granular	1.6 to 2.5	6.5 to 7.5	Low	High	High	Low.
85 to 95	100	100	0.20 to 0.50	Subangular blocky	1.6 to 2.5	6.5 to 7.5	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Coarse blocky	2.2 to 2.5	8.0 to 9.0	Low	High	High	Low.
75 to 95	95 to 100	100	0.20 to 0.50	Massive blocky	1.6 to 2.5	8.0 to 9.0	Low	High	High	Low.
80 to 95	100	100	0.20 to 0.50	Granular	1.6 to 2.5	7.0 to 8.0	Low	Moderate	High	Low.
80 to 95	100	100	0.20 to 0.50	Subangular blocky	1.6 to 2.5	8.0 to 9.0	Low	Moderate	High	Low.
80 to 95	100	100	0.20 to 0.50	Subangular blocky	1.6 to 2.5	8.0 to 9.0	Low	Moderate	High	Low.
80 to 95	100	100	0.20 to 0.50	Subangular blocky	1.6 to 2.5	8.0 to 9.0	Low	Moderate	High	Low.
80 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	6.5 to 7.5	Low	High	High	Low.
25 to 50	95 to 100	100	0.8 to 2.50	Structureless	1.5 to 2.4	6.5 to 7.5	Low	Low	Low	Low.
30 to 60	95 to 100	100	0.8 to 2.50	Structureless	1.5 to 2.4	6.5 to 7.5	Low	Low	Low	Low.
70 to 85	95 to 100	100	0.2 to 0.50	Weak prismatic	1.6 to 2.5	6.5 to 7.0	Low	Moderate	Low	Low.
30 to 60	95 to 100	100	0.8 to 2.50	Structureless	1.5 to 2.4	6.5 to 7.0	Low	Low	Low	Low.
25 to 40	95 to 100	100	0.8 to 2.50	Structureless	1.5 to 2.4	7.0 to 7.5	Low	Low	Low	Low.
40 to 50	100	100	0.8 to 2.50	Blocky and granular	1.5 to 2.4	6.7 to 7.5	Low	Low	Low	Low.
35 to 55	100	100	0.8 to 2.50	Medium blocky	1.6 to 2.5	6.5 to 7.5	Low	Low	Low	Low.
30 to 50	100	100	0.8 to 2.50	Blocky and granular	1.5 to 2.4	7.0 to 8.0	Low	Low	Low	Low.

TABLE 4.--*Brief description of soils of Haskell County,*

Map symbol	Soil name	Brief description of soil[1]	Depth from surface	Classification: USDA Texture	Unified	AASHO
			Inches			
Ms	Miller silty clay loam.	Inorganic silty clay of medium to high plasticity; developed in outwash from the Permian red beds or from soils formed in materials derived from the Permian red beds; stratified; subject to overflow; nearly level.	0 to 8	Silty clay loam	CL,ML	A-7
			8 to 36	Clay	CL-CH	A-7
			36 to 72	Clay	CL-CH	A-7
Mr	Miller clay.	Inorganic clay of medium to high plasticity; developed from alluvial outwash material; material is variable and stratified; soils are level or occur in depressions.	0 to 30	Clay	CH	A-7
			30 to 50	Clay	CL-CH	A-7
No	Norwood silty clay loam.	Inorganic silt or clayey silt of low plasticity from outwash of the Permian red beds; nearly level flood plains.	0 to 20	Silty clay loam	ML	A-4
			20 to 48	Silt loam	ML	A-4
OcB	Owens clay, 1 to 3 percent slopes.	Inorganic clay of high plasticity; developed from transitional areas of Permian red beds and limestone formations; slopes are mainly less than 3 percent.	0 to 7	Clay	CH	A-7
			7 to 35	Clay	CH	A-7
			35 to 40	Clay	CH	A-7
PfA	Portales fine sandy loam, 0 to 1 percent slopes.	Mixture of silty sand and clay of low to medium plasticity; mostly in nearly level depressions.	0 to 7	Fine sandy loam	SM	A-2, A-4
			7 to 16	Sandy clay loam	CL	A-7
			16 to 27	Clay loam	CL-CH	A-7
			27 to 34	Clay loam	CL-CH	A-7
			34 to 56	Clay loam	CL-CH	A-7
			56 to 60	Fine sandy loam	SM	A-2, A-4
PcA	Portales clay loam, 0 to 1 percent slopes.	Inorganic clay loam of medium plasticity; mostly nearly level depressions near the heads of streams.	0 to 7	Clay loam	CL-CH	A-7
			7 to 15	Clay loam	CL-CH	A-7
			15 to 32	Clay loam	CL-CH	A-7
			32 to 50	Clay loam	CL-CH	A-7
			50 to 60	Clay loam	CL-CH	A-7
Ra	Randall clay.	Inorganic clay of medium to high plasticity; in natural depressions in level areas and approximately 2 feet lower than the surrounding area; in periods of excessive rainfall the areas are covered with water and become a natural lake.	0 to 6	Clay	CL-CH	A-7
			6 to 60	Clay	CL-CH	A-7
RcA RcB	Roscoe clay, 0 to 1 percent slopes. Roscoe clay, 1 to 3 percent slopes.	Inorganic clay of medium to high plasticity; developed from alluvial materials that overlie Permian red beds, below a depth of 50 to 60 inches; contains an estimated 2 to 3 percent of gypsum.	0 to 19	Clay	CH-CL, and CL-CH	A-7
			19 to 32	Clay	CL-CH, and CL-CH	A-7
			32 to 53	Clay	CL-CH	A-7
			53 to 60	Clay	CL-CH	A-7
			60 to 72	Clay	CL-CH	A-7
Sa	Sandy alluvial fans.	Mixture of sandy silt and silt, sand, and gravel on fans; stratified; contains numerous pebbles of quartzite; in a few places beds of gravel occur at a depth below 8 feet; flooded in frequently.	0 to 72+	Fine sandy loam	GM-SM	A-2, A-4
Sk Sh Sm	Springer loamy fine sand, undulating. Springer loamy fine sand, hummocky. Springer-Altus loamy fine sands.	Mixture of silty sand or sand and silt of low plasticity; developed from eolian sands of Quaternary age; topography consists of stabilized sand dunes and complex slopes of less than 5 percent.	0 to 20	Fine sand to loamy fine sand	SM, SP-SM	A-2, A-4
			20 to 46	Fine sandy loam to sandy clay loam.	SC or CL	A-2, A-6
			46 to 56	Sandy clay loam	ML-CL	A-4
			56 to 60	Sandy clay loam	ML-CL	A-4
Sr	Spur soils.	Clayey sand or a mixture of sandy and clayey alluvial materials from the Abilene and Roscoe soils; level to gently undulating flood plain.	0 to 6	Very fine sandy loam	SM	A-2, A-4
			6 to 17	Clay loam	SC	A-2, A-6
			17 to 38	Clay loam	SC	A-2, A-6
			38 to 54	Sandy clay loam	SC-CL	A-6, A-7
StB StC StC2	Stamford clay, 1 to 3 percent slopes. Stamford clay, 3 to 5 percent slopes. Stamford clay, 3 to 5 percent slopes, eroded.	Inorganic, dense clay developed from Permian red beds; has high plasticity; gully erosion on the steeper slopes.	0 to 4	Clay	CL-CH	A-7
			4 to 16	Clay	CL-CH	A-7
			16 to 30	Clay	CL-CH	A-7
			30 to 44	Clay	CL-CH	A-7
			44 to 52	Clay	CL-CH	A-7
TaD TaF	Tarrant stony clay, 0 to 8 percent slopes. Tarrant stony clay, 8 to 20 percent slopes.	About 6 inches of inorganic clay over fragments of limestone; many large fragments of limestone on surface; depth to limestone bedrock is less than 2 feet.	0 to 6	Stony clay	SC	A-2
			6+	Gravel	([3])	([3])

See footnotes at end of table.

Tex., and their estimated physical properties--Continued

Percentage passing-- No. 200 sieve	Percentage passing-- No. 10 sieve	Percentage passing-- No. 4 sieve	Permeability	Structure	Available water capacity	Reaction	Salinity	Dispersion	Shrink-swell potential	Gypsum content
			Inches per hour		*Inches per foot of soil*	*pH*				
85 to 95	100	100	0.20 to 0.50	Subangular blocky	1.6 to 2.50	7.0 to 8.0	Low	Moderate	High	Low.
85 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	8.0 to 8.5	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	8.0 to 8.5	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Subangular blocky	2.2 to 2.5	7.0 to 8.0	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Massive	2.2 to 2.5	7.0 to 8.0	Low	High	High	Low.
80 to 90	100	100	0.20 to 0.50	Massive	1.6 to 2.5	7.0 to 8.0	Low	Moderate	Low to moderate	Low.
80 to 90	100	100	0.20 to 0.50	Massive	1.6 to 2.5	7.5 to 8.5	Low	Low	Low to moderate	Low.
85 to 95	100	100	0.05 to 0.20	Subangular blocky	2.2 to 2.5	7.5 to 8.5	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	7.5 to 8.5	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Massive	2.2 to 2.5	6.5 to 7.0	Low	High	High	Low.
30 to 45	70 to 100	100	0.8 to 2.50	Granular	1.5 to 2.4	7.0 to 7.5	Low	Low	Low	Low.
70 to 85	100	100	0.20 to 0.50	Granular	1.5 to 2.4	7.0 to 8.0	Low	Moderate	Moderate	Low.
80 to 90	100	100	0.20 to 0.50	Granular	1.6 to 2.5	8.0 to 8.5	Low	Moderate	High	Low.
80 to 90	100	100	0.20 to 0.50	Granular	1.6 to 2.5	8.0 to 8.5	Low	Moderate	High	Low.
80 to 90	100	100	0.20 to 0.50	Granular	1.6 to 2.5	8.0 to 8.5	Low	Moderate	High	Low.
30 to 45	70 to 100	100	0.8 to 2.50	Granular	1.5 to 2.4	7.0 to 8.0	Low	Low	Low	Low.
80 to 90	100	100	0.20 to 0.50	Granular	1.6 to 2.5	7.0 to 8.0	Low	Moderate	Low to moderate	Low.
85 to 95	100	100	0.05 to 0.20	Subangular blocky	2.2 to 2.5	7.0 to 8.0	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	7.0 to 8.0	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	8.0 to 8.5	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	8.0 to 8.5	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Weak blocky	2.2 to 2.5	6.5 to 7.5	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Weak blocky	2.2 to 2.5	6.5 to 7.5	Low	High	High	Low.
85 to 90	100	100	0.20 to 0.50	Subangular blocky	1.6 to 2.5	7.0 to 8.0	Low	Low	High	Low.
75 to 90	100	100	0.20 to 0.50	Angular blocky	1.6 to 2.5	8.0 to 8.5	Low	Moderate	High	Low.
75 to 95	100	100	0.20 to 0.50	Angular blocky	1.6 to 2.5	8.0 to 8.5	Low	Moderate	High	Moderate to high.
75 to 95	100	100	0.20 to 0.50	Angular blocky	1.6 to 2.5	8.0 to 8.5	Low	Moderate	High	Moderate to high.
75 to 95	100	100	0.20 to 0.50	Massive	1.6 to 2.5	8.0 to 8.5	Low	Moderate	High	Moderate to high.
25 to 40	85 to 90	85 to 100	0.8 to 2.50	Granular	1.5 to 2.4	7.5 to 8.0	Low	Low	Low	Low.
25 to 50	75 to 100	100	2.50 to 5.00	Single grain	1.0 to 1.5	6.5 to 7.5	Low	Low	Low	Low.
30 to 60	75 to 100	100	2.50 to 5.00	Structureless	1.5 to 2.4	6.5 to 7.2	Low	Low	Low	Low.
70 to 85	95 to 100	100	0.8 to 2.50	Structureless	1.5 to 2.4	7.0 to 7.5	Low	Low to moderate	Low	Low.
70 to 85	75 to 100	100	0.8 to 2.50	Structureless	1.5 to 2.4	7.0 to 7.5	Low	Low to moderate	Low	Low.
30 to 50	80 to 85	100	0.2 to 0.50	Weakly granular	1.5 to 2.4	6.5 to 7.5	Low	Low	Low to moderate	Low.
25 to 40	45 to 85	100	0.20 to 0.50	Subangular blocky	1.6 to 2.5	6.5 to 7.5	Low	Moderate	Low to moderate	Low.
25 to 40	45 to 85	100	0.20 to 0.50	Blocky	1.6 to 2.5	6.5 to 7.5	Low	Moderate	Low to moderate	Low.
50 to 55	95 to 100	100	0.20 to 0.50	Massive	1.5 to 2.4	7.0 to 8.0	Low	Moderate	Low to moderate	Low.
85 to 95	100	100	0.05 to 0.20	Weak blocky	2.2 to 2.5	7.0 to 7.5	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Medium blocky	2.2 to 2.5	7.5 to 8.0	Low	High	High	Low.
85 to 95	100	100	0.20 to 0.50	Medium blocky	2.2 to 2.5	8.0 to 8.5	Low	High	High	Low.
85 to 95	100	100	0.20 to 0.50	Medium blocky	2.2 to 2.5	8.0 to 8.5	Low to moderate	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Massive	2.2 to 2.5	8.0 to 8.5	Low to moderate	High	High	Low.
10 to 30	30 to 40	40 to 75	0.20 to 0.50	Subangular blocky to granular.	2.2 to 2.5	8.0 to 8.5	Low	Low	High	Low.
0 to 5	7 to 10	15 to 25	0.00 to 0.50	Cobbles to bedrock	0.0	8.0 to 8.5	Low	Low	Low	Low.

TABLE 4.--*Brief description of soils of Haskell County,*

Map symbol	Soil name	Brief description of soil[1]	Depth from surface	Classification: USDA Texture	Classification: Unified	Classification: AASHO
			Inches			
TcA TcB TcB2 TcC TrA	Tillman clay loam, 0 to 1 percent slopes. Tillman clay loam, 1 to 3 percent slopes. Tillman clay loam, 1 to 3 percent slopes, eroded. Tillman clay loam, 3 to 5 percent slopes. Tillman-Foard complex, 0 to 1 percent slopes.	Inorganic clay and silty clay of medium to high plasticity; developed in outwash material from the Permian red beds.	0 to 6 6 to 22 22 to 42 42 to 62	Clay loam Silty clay loam to silt loam Silt loam, silty clay loam to silty clay. Silt loam to silty clay loam	CL, CL-CH CL, CL-CH CL, CL-CH CL	A-6, A-7 A-7 A-6, A-7 A-6, A-7
TmB TmC TmC2	Tillman clay loam, shallow, 0 to 3 percent slopes. Tillman clay loam, shallow, 3 to 5 percent slopes. Tillman clay loam, shallow, 1 to 5 percent slopes, eroded.	Inorganic clay of medium to high plasticity; developed from Permian red beds.	0 to 7 7 to 18 18 to 26 26 to 36	Clay loam Clay Clay Clay	CL, CL-CH CL-CH CL-CH CL-CH	A-6, A-7 A-7 A-7 A-7
TtA	Tipton loam, 0 to 1 percent slopes.	Inorganic silt of slight plasticity; developed from alluvial materials on low, nearly level terraces in positions that are above overflow.	0 to 16 36 to 50	Silt loam Silt loam to sandy clay loam	ML ML	A-4 A-4
VaA VaB VcB VeB	Valera clay, 0 to 1 percent slopes. Valera clay, 1 to 3 percent slopes. Valera clay, shallow, 0 to 3 percent slopes. Valera stony clay, 0 to 3 percent slopes.	Inorganic clay of medium to high plasticity; developed over limestone; bedrock at a depth of approximately 2½ feet; level to gently sloping plateau.	0 to 7 7 to 25 25 to 30 30+	Clay Clay Caliche Limestone bedrock	CH CH ([2]) ([4])	A-7 A-7 ([2]) ([4])
VnD Vr	Vernon clay, 3 to 8 percent slopes. Vernon complex.	Inorganic clay of high plasticity; developed from Permian red bed material; a few to many gullies.	0 to 10 10 to 30 30 to 48	Clay and silty clay to silty clay loam Clay loam and sandy clay loam to silty clay loam. Clay	CL, CL-CH CL, CL-CH CL, CL-CH	A-6, A-7 A-6, A-7 A-7
WcA WcB WcB2	Wichita clay loam, 0 to 1 percent slopes. Wichita clay loam, 1 to 3 percent slopes. Wichita clay loam, 1 to 3 percent slopes, eroded.	Inorganic silt or clayey silt of slight to medium plasticity to depths of 7 to 20 inches; overlies inorganic clay of medium to high plasticity; developed from alluvial material on high terraces.	0 to 7 7 to 20 20 to 44 44 to 54	Silty clay loam to clay loam Silty clay Clay Clay	ML, MH ML, MH CL, CL-CH CL, CL-CH	A-7 A-7 A-7 A-7
WgB	Wichita gravelly loam, 1 to 5 percent slopes.	Inorganic gravelly silt of low plasticity to a depth of 8 inches; overlies clayey gravel of medium to high plasticity; developed from alluvial material on high terraces.	0 to 8 8 to 60	Gravelly loam Gravel to gravelly clay	ML GC	A-4 A-2
Ya	Yahola fine sandy loam.	Mixture of sand and silt of low plasticity; developed in alluvial material from the Permian red beds and from soils developed from mixtures of Permian red beds; the soil is variable and stratified and is on undulating flood plains.	0 to 40 40 to 60	Fine sandy loam Fine sandy loam	SM SM	A-2 to A-4 A-2 to A-4

[1] Depth to bedrock or a high water table shown only where significant, that is, at a depth of 2 to 5 feet.
[2] Not estimated because of wide range of variation in this material.
[3] Limestone fragments.
[4] Limestone rock.

Tex., and their estimated physical properties--Continued

Percentage passing-- No. 200 sieve	No. 10 sieve	No. 4 sieve	Permeability	Structure	Available water capacity	Reaction	Salinity	Dispersion	Shrink-swell potential	Gypsum content
			Inches per hour		*Inches per foot of soil*	*pH*				
85 to 95	100	100	0.20 to 0.50	Subangular blocky	1.6 to 2.5	6.5 to 7.5	Low	Moderate	High	Low.
75 to 90	100	100	0.20 to 0.50	Angular to subangular blocky.	1.6 to 2.5	7.5 to 8.0	Low	High	High	Low.
70 to 95	100	100	0.05 to 0.20	Blocky	1.6 to 2.5	8.0 to 8.5	Low	High	High	Low.
85 to 94	100	100	0.05 to 0.20	Blocky to massive	1.6 to 2.5	8.0 to 8.5	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Subangular blocky	1.6 to 2.5	6.5 to 7.5	Low	Moderate	High	Low.
85 to 95	100	100	0.05 to 0.20	Medium blocky	2.2 to 2.5	6.5 to 7.5	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Medium blocky	2.2 to 2.5	6.5 to 7.5	Low	High	High	Low.
85 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	6.5 to 7.5	Low to moderate	High	High	Low.
80 to 90	100	100	0.20 to 0.50	Granular	1.6 to 2.5	6.5 to 7.5	Low	Low	Low to moderate	Low.
80 to 90	100	100	0.20 to 0.50	Granular	1.6 to 2.5	7.0 to 8.0	Low	Low	Low to moderate	Low.
85 to 95	95 to 100	100	0.20 to 0.50	Granular to blocky	2.2 to 2.5	8.0 to 8.5	Low	High	High	Low.
85 to 95	95 to 100	100	0.20 to 0.50	Subangular blocky	2.2 to 2.5	8.0 to 8.5	Low	High	High	Low.
(2)	(2)	(2)	1.0 to 1.50	Subangular blocky	0.7 to 1.0	8.0 to 8.5	Low	Moderate	Low	Low.
---	---	---	---	---	---	8.0 to 8.5	---	---	---	---
80 to 95	95 to 99	96 to 100	0.05 to 0.20	Blocky	1.6 to 2.5	8.0 to 8.5	Low	High	High	Low.
80 to 95	97 to 100	99 to 100	0.05 to 0.20	Massive	1.6 to 2.5	8.0 to 8.5	Low	High	High	Low.
80 to 95	95 to 100	100	0.05 to 0.20	Massive	2.2 to 2.5	8.0 to 8.5	Low	High	High	Low.
80 to 95	100	100	0.20 to 0.50	Structureless	1.6 to 2.5	6.5 to 7.5	Low	Moderate	High	Low.
80 to 95	100	100	0.20 to 0.50	Subangular blocky to prismatic.	1.6 to 2.5	6.5 to 7.5	Low	Moderate	High	Low.
80 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	7.0 to 8.0	Low	High	High	Low.
80 to 95	100	100	0.05 to 0.20	Blocky	2.2 to 2.5	8.0 to 8.5	Low	High	High	Low.
40 to 45	55	70	0.5 to 0.75	Structureless	1.0 to 1.5	7.0 to 7.5	Low	Moderate	Low	Low.
20	35	50	0.2 to 0.5	Structureless	0.7 to 1.0	8.0 to 8.5	Low	Low	Low	Low.
25 to 50	100	100	0.8 to 2.50	Structureless	1.5 to 2.4	7.0 to 8.0	Low	Low	Low to moderate	Low.
25 to 50	100	100	0.8 to 2.50	Structureless	1.5 to 2.4	8.0 to 8.5	Low	Low	Low to moderate	Low.

Soil and map symbol	Suitability for--			Suitability as source of--		Suitability for vertical alinement of highways--	
	Winter grading	Road subgrade	Road fill	Topsoil[1]	Sand and gravel	Soil materials[2]	Drainage
Abilene clay loam (AcA, AcB, AcB2)	Good	Fair to very poor	Stable if moisture content is kept low; in places has excess gypsum below a depth of 52 inches.	Fair	Poor	Poor	Very poor; impervious below a depth of 20 inches.
Abilene loam (AdA, AdB, Ae)	Good	Poor to very poor	Good to poor; stable if moisture content is kept low.	Good	Poor	Poor to good	Fair to very poor below a depth of 20 inches.
Alluvial land (Al)	Excellent	Excellent to fair	Good if drained and properly compacted.	Poor to good	Good to fair	Good if drained	Fair to good
Altus loamy fine sand (At)	Good	Fair to poor	Good to poor; stable if moisture content is kept low.	Fair	Poor	Good to excellent	Poor to very poor; impervious below a depth of 26 inches.
Byrds clay (BcA, BcB, ByB)	Good	Very poor to a depth of 21 inches; excellent below that depth.	Good to poor to a depth of 21 inches; stable if moisture content is kept low; otherwise, excellent.	Poor	Possible source of limestone for crushing.	Poor to a depth of 21 inches; excellent below that depth.	Very poor to a depth of 21 inches; excellent below that depth.
Cottonwood clay loam (Cc)	Good	Very poor; high content of gypsum.	Very poor because of excess gypsum.	Poor	Unsuitable	Very poor	Very poor; excessive seepage and piping because of the content of gypsum.
Drake clay loam (DrB)	Good	Poor	Good to poor; stable if moisture content is kept low.	Fair	Poor	Poor to good	Fair to poor
Enterprise fine sandy loam (EnB, EnC2).	Excellent	Good to fair	Good if drained and properly compacted.	Excellent	Poor	Fair to good	Fair to poor
Enterprise-Miles complex (EpD)	Good	Fair to very poor	Fair to very poor	Good to excellent.	Fair	Poor to good	Fair to poor
Foard clay loam (FcA, FcB, FcB2)	Good	Very poor	Good to poor; stable if moisture content is kept low.	Poor	Poor	Poor	Very poor; impervious at a depth below 6 inches.
Hollister clay loam (HoA, HoB)	Good	Very poor	Good to poor; stable if moisture content is kept low.	Poor	Poor	Poor	Poor to very poor; impervious at a depth below 32 inches.
Mansker clay loam (MaB, MaC2)	Good	Poor to very poor	Good to poor; stable if moisture content is kept low.	Fair	Poor	Poor	Poor to very poor; impervious below a depth of 40 inches.
Miles loamy fine sand (Mh2, Mk)	Excellent	Good to poor	Good to poor; satisfactory if drained and properly compacted.	Fair	Poor	Fair to good	Poor to very poor
Miles fine sandy loam (MfA, MfB, MfB2, MfC2, MfD2, Md, Md2).	Excellent	Good to fair	Good; stable when dry	Good	Poor	Fair to good	Fair to a depth of 15 inches; poor to very poor below that depth.
Miller silty clay loam (Ms)	Good	Poor to very poor	Poor; stable if moisture content is kept low.	Fair	Poor	Poor	Very poor; impervious
Miller clay (Mr)	Fair	Poor to very poor	Poor; stable if moisture content is kept low.	Poor	Poor	Poor	Very poor; impervious

See footnotes at end of table.

of the soils in Haskell County, Tex.

Soil features affecting suitability for--						
Dikes or levees	Farm ponds: Reservoir area	Farm ponds: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Stable to fairly stable-----	Good to poor; in places has excess gypsum below a depth of 52 inches.	Stable to fairly stable; use with flat slopes; in places has excess gypsum below a depth of 52 inches.	Slow internal drainage at depths of 19 to 52 inches.	Slow permeability below a depth of 19 inches.	No problem--------	No problem.
Very stable to fairly stable.	Fair; moderate seepage-------	Very stable; use for impervious cores and blankets.	Fair--------------	No problem-----------------	No problem--------	No problem.
Fairly stable---------------	Poor; in places has alluvial deposits of sand; excessive seepage.	Fairly stable; not suited to shells.	Not tillable------	Not tillable; rapid permeability.	Frequent flooding; not tillable	Easily eroded by water; eroded by wind if not covered by vegetation; protect from deposition by wind.
Very stable to fairly stable.	Fair; moderate seepage-------	Very stable to fairly stable; can be used for cores and blankets.	Slow internal drainage at depths between 26 and 42 inches; fair.	Rapid permeability affects designs for surface irrigation; surface layer low in water-holding capacity.	Complex slopes; not cohesive in surface layer; wind erosion.	Deposition from wind erosion.
Very stable to a depth of 21 inches; rock below that depth.	Fair to good; bedrock affects excavation; may seep.	Very stable to a depth of 21 inches; suitable for pervious blankets and shells of dams below that depth.	Poor internal drainage; bedrock is at a depth of 21 inches.	Shallow clay soil; bedrock is at a depth of 21 inches.	Bedrock is at a depth of 21 inches.	Very stable below a depth of 21 inches; bedrock limits depth of shaping.
Very poor-------------------	Poor; excessive gypsum-------	Unsuitable because of excessive gypsum; very poor.	Piping to be expected; poor.	Gypsum rock at a depth of 20 inches; very poor.	Gypsum rock at a depth of 20 inches; very poor.	Very poor; erodes easily; gypsum rock limits depth of shaping.
Fairly stable---------------	Poor to fair; moderate seepage.	Fairly stable; use for cores.	Fair--------------	Excessive slope for surface irrigation.	No problem--------	Poor stability.
Fairly stable to stable-----	Poor-------------------------	Fairly stable to stable; may be used for cores.	Complex slopes----	Moderate permeability affects designs for surface irrigation.	No problem--------	Erodes easily.
Very stable to stable-------	Poor-------------------------	Stable-----------------------	Within the complex internal drainage of Miles and Vernon series is poor to fair.	Excessive slopes for surface irrigation.	Steep slopes and gully erosion.	Erodes easily.
Stable to fairly stable, use flat slopes.	Excellent--------------------	Stable to fairly stable with flat slopes.	Poor internal drainage.	Slow permeability----------	High shrink-swell potential.	Poor stability.
Stable to fairly stable, use flat slopes.	Excellent--------------------	Stable to fairly stable with flat slopes.	Very slow internal drainage at depths between 32 and 52 inches.	Slow permeability at depths below 32 inches.	No problem--------	Poor stability.
Stable to fairly stable with flat slopes.	Poor to fair; moderate seepage.	Stable to fairly stable with flat slopes.	Slow internal drainage.	Shallow surface soil affects land leveling; accumulations of calcium carbonate below a depth of 10 inches.	High shrink-swell potential.	Poor to fair stability.
Fairly stable to poorly stable; use with proper control.	Poor; excessive seepage------	Fairly stable to poor in structure; can be used with proper control.	Slow internal drainage at depths between 20 and 38 inches.	Rapid permeability; complex slopes.	Complex slopes----	Erodes easily.
Fairly stable to poorly stable; use with proper control.	Poor; excessive seepage------	Fairly stable to poor in structure; can be used with proper control.	None--------------	Rapid permeability affects design for surface irrigation; complex slopes affect land leveling.	Complex slopes; gully erosion.	Erodes easily.
Fair stability with flat slopes.	Poor to fair; stratified-----	Stable to fairly stable with flat slopes.	Slow internal drainage; high dispersion affects deep cuts.	Shallow surface soil affects land leveling; slow permeability; complex slopes; periodic flooding.	Complex slopes; high shrink-swell potential; periodic flooding.	Poor stability.
Very stable to fairly stable with flat slopes.	Fair to good-----------------	Stable to fairly stable with flat slopes; use for impervious cores and blankets.	Very slow internal drainage.	Periodic flooding; slow permeability.	Complex slopes----	Poor stability.

Soil and map symbol	Suitability for--			Suitability as source of--		Suitability for vertical alinement of highways--	
	Winter grading	Road subgrade	Road fill	Topsoil[1]	Sand and gravel	Soil materials[2]	Drainage
Norwood silty clay loam (No)	Good	Poor to very poor	Poor; unstable when wet	Fair	Poor	Poor	Fair to poor
Owens clay (OcB)	Good	Very poor	Poor; stable if moisture content is kept low.	Poor	Poor	Poor	Very poor; impervious
Portales fine sandy loam (PfA)	Good to excel-lent.	Poor to very poor	Poor; stable if moisture content is kept low.	Fair	Poor	Poor	Poor to very poor
Portales clay loam (PcA)	Fair	Poor to very poor	Poor; stable if moisture content is kept low.	Fair	Poor	Poor	Very poor; impervious at a depth below 7 inches.
Randall clay (Ra)	Poor	Poor to very poor	Poor; stable if moisture content is kept low.	Poor	Poor	Poor	Very poor; impervious
Roscoe clay (Rca, RcB)	Fair	Poor to very poor	Poor; stable if moisture content is kept low; in places excess gypsum is below a depth of 32 inches	Excellent	Poor	Poor	Very poor
Sandy alluvial fans (Sa)	Excellent	Excellent to fair	Good if drained and properly compacted.	Poor to good	Good to fair	Good if drained	Fair to good
Springer loamy fine sand (Sh, Sk, Sm).	Excellent	Good to fair	Good to poor; satisfactory if drained and properly compacted; in places excess gypsum is at depths below 32 inches.	Fair	Poor	Good	Fair to good
Spur soils (Sr)	Good	Fair to poor	Good to poor; stable if moisture content is kept low.	Fair	Poor	Poor to fair	Poor
Stamford clay (StB, StC, StC2)	Fair	Poor to very poor	Poor; stable if moisture content is kept low.	Poor	Poor	Poor	Very poor; impervious
Tarrant stony clay (TaD, TaF)	Poor	Surface layer is poor; excellent below a depth of 6 inches.	Excellent if stony material is included.	Poor	Possible source of limestone for crushing.	Poor to depths of 0 to 6 inches; good to excellent below that depth.	Fair to poor to a depth of 6 inches.
Tillman clay loam (TcA, TcB, TcB2, TcC, TrA).	Good	Poor to very poor	Poor; stable if moisture content is kept low.	Fair	Poor	Poor	Very poor; impervious at depths below 22 inches.
Tillman clay loam, shallow (TmB, TmC, TmC2).	Fair	Poor to very poor	Poor; stable if moisture content is kept low.	Fair	Poor	Poor	Very poor; impervious

See footnotes at end of table.

Soil features affecting suitability for--						
Dikes or levees	Farm ponds: Reservoir area	Farm ponds: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Poor stability	Poor to fair; may have excessive seepage; stratified.	Poor stability; use proper control and no rolled-fill construction.	Slow internal drainage; stratified; moderate dispersion.	Stratified	No problem	Protect from deposition by wind.
Fair stability with flat slopes.	Fair to good	Fair stability with flat slopes; use for thin cores and blankets.	Very slow internal drainage; high dispersion.	Shallow surface soil affects land leveling; slow permeability.	Plastic and sticky when wet; high shrink-swell potential.	Protect from deposition by wind.
Very stable to fairly stable with flat slopes.	Poor; excessive seepage	Stable to fairly stable with flat slopes; use for thin cores and blankets.	No problem	No problem	No problem	Protect from deposition by wind.
Very stable to fairly stable with flat slopes.	Fair to good; high in calcium carbonate.	Stable to fairly stable with flat slopes; use for thin cores and blankets.	Slow internal drainage at depths below 7 inches; high dispersion affects deep cuts.	Shallow surface soil affects land leveling; slow permeability at depths below 7 inches.	Plastic and sticky when wet at depths below 7 inches.	Poor stability at depths below 7 inches if shaped.
Very stable to fairly stable with flat slopes.	Good	Stable to fairly stable with flat slopes; use for thin cores and blankets.	Very slow internal drainage; high dispersion affects deep cuts; natural lake area.	Slow permeability; surface drainage needed.	Plastic and sticky when wet.	Poor stability.
Very stable to fairly stable with flat slopes; in places has excess gypsum below a depth of 32 inches.	Poor to fair; gypsum at a depth below 32 inches.	Stable to fairly stable with flat slopes; use for thin cores and blankets.	Slow internal drainage; moderate dispersion.	Land leveling affected by moisture content.	Plastic and sticky when wet.	Poor stability.
Fairly stable	Poor; excessive seepage	Fairly stable; not suited to shells or impervious cores.	Not tillable	Not tillable; rapid permeability.	Tillable, but too much sand, not enough soil binder.	Easily eroded by water; eroded by wind if not covered by vegetation; protect from deposition by wind.
Fairly stable to very stable	Poor; excessive seepage	Fairly stable; can be used with proper control.	Deposition as the result of wind erosion:	Surface soil has low water-holding capacity; rapid permeability affects designs for irrigation.	Too much sand, not enough soil binder.	Easily eroded; protect from deposition by wind.
Fairly stable	Poor to fair; stratified material.	Fairly stable; use for impervious cores and blankets.	Slow internal drainage.	Complex slopes; periodic flooding.	Complex slopes; periodic flooding.	Complex slopes; deposition from water; periodic flooding.
Very stable to fairly stable with flat slopes.	Excellent	Stable to fairly stable with flat slopes; use for cores and blankets.	Slow internal drainage; high dispersion.	Slow permeability; depth of top soil affects land leveling.	High shrink-swell potential; gully erosion.	Poor stability; establishing grass cover is affected by crusting of surface soil.
Very stable to a depth of 6 inches; very stable, but pervious, below that depth.	Poor; limestone bedrock affects excavation.	Fairly stable to very stable to depths of 0 to 6 inches; use for cores; below a depth of 6 inches, use for pervious shells and blankets.	Bedrock at depths of 2 feet or less.	Bedrock at depths of 2 feet or less.	Shallow depth of soil; bedrock at a depth of less than 2 feet.	Not enough soil to allow shaping; bedrock at a depth of 2 feet or less.
Very stable to fairly stable with flat slopes.	Excellent	Stable to fairly stable with flat slopes; use for impervious cores and blankets.	Very slow internal drainage at depths below 22 inches; high dispersion of subsurface strata.	Slow permeability at depths below 22 inches.	Plastic and sticky when wet; high shrink-swell potential.	Fairly stable.
Very stable to fairly stable with flat slopes.	Excellent	Stable to fairly stable with flat slopes; use for impervious cores and blankets.	Very slow internal drainage; high dispersion affects deep cuts.	Shallow surface soil affects land leveling; slow permeability.	Gully erosion on stronger slopes; plastic and sticky when wet; high shrink-swell potential.	Fairly stable; shallow surface soil; gully erosion.

TABLE 5.--*Engineering interpretations of*

Soil and map symbol	Suitability for--			Suitability as source of--		Suitability for vertical alinement of highways--	
	Winter grading	Road subgrade	Road fill	Topsoil[1]	Sand and gravel	Soil materials[2]	Drainage
Tipton loam (TtA)	Fair	Good to fair	Poor; unstable if moist	Fair to good	Poor	Poor to fair	Fair to poor
Valera clay (VaA, VaB, VcB, VeB, VnD).	Fair	Poor to very poor	Poor; stable to a depth of 25 inches if moisture content is kept low.	Poor	Possible source of caliche and limestone for crushing.	Poor to a depth of 25 inches; good to excellent below that depth.	Very poor to a depth of 25 inches.
Vernon clay (VnD, Vr)	Fair	Very poor	Poor; stable if moisture content is kept low.	Poor	Poor	Poor	Very poor; impervious
Wichita clay loam (WcA, WcB, WcB2)	Good	Poor to very poor	Poor; stable if moisture content is kept low.	Fair	Poor	Poor	Poor to fair to a depth of 20 inches; very poor below that depth.
Wichita gravelly loam (WgB)	Excellent	Fair to good	Good	Poor	Excellent	Good	Very good
Yahola fine sandy loam (Ya)	Excellent	Good to fair	Good; stable if drained and properly compacted.	Excellent	Poor	Poor to fair	Fair to poor

[1] Applies to surface soil only.
[2] Based on effect of shrink-swell potential on design and construction.

TABLE 6.--*Engineering test data for soil*

Soil name and location	Horizon	Depth	Liquid limit	Plasticity index	Field moisture equivalent	Shrinkage limit	Lineal shrinkage	Shrinkage ratio	Soil binder
Abilene clay loam, 0 to 1 percent slopes (parent material from outwash)--									
8.8 miles north-northwest of Haskell (modal profile):		*Inches*	*Percent*		*Percent*	*Percent*	*Percent*		*Percent*
58-79-R	B_1	11-19	46	24	29	11	15.8	1.98	99
58-80-R	B_2	19-33	47	26	29	13	15.8	1.99	99
58-81-R	C_{ca}	52-72	40	24	22	11	14.5	2.05	97
6.4 miles south and 2.17 miles west of Rule:									
58-69-R	B_1	9-14	42	22	32	8	16.6	1.87	98
58-70-R	B_2	14-35	51	30	33	11	17.6	1.98	98
58-71-R	C_{ca}	60-72+	44	28	26	12	17.1	2.01	90
0.4 mile east of Weinert:									
58-115-R	B_1	6-14	50	28	31	12	17.0	1.94	100
58-116-R	B_2	14-24	50	29	31	12	17.2	1.98	100
58-117-R	C_{ca}	40-54+	38	22	24	15	11.2	1.86	85
Hollister clay loam, 0 to 1 percent slopes (parent material from Permian red beds)--									
4.3 miles south and 2.7 miles west of Haskell (modal profile):									
58-93-R	B_1	8-14	49	25	32	13	15.8	1.90	99
58-94-R	B_2	14-32	54	30	33	14	17.8	1.94	99
58-95-R	C_{ca}	52-72	47	27	25	12	16.1	1.99	99
5.3 miles south and 6.1 miles west of Haskell:									
58-96-R	B_1	9-13	45	21	32	14.6	14.0	1.85	99
58-97-R	B_2	13-38	54	30	35	12	18.5	1.99	98
58-98-R	C_{ca}	58-72	43	25	27	12	14.6	1.99	95
13 miles north-northeast of Haskell:									
58-110-R	B_1	6-15	38	20	28	15	10.9	1.83	100
58-111-R	B_2	15-30	51	30	32	11	17.9	1.99	99
58-112-R	C_{ca}	52-72+	41	24	25	12	13.9	1.97	88

See footnotes at end of table.

the soils in Haskell County, Tex.--Continued

Soil features affecting suitability for--						
Dikes or levees	Farm ponds: Reservoir area	Farm ponds: Embankment	Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Poor stability---------------	Fair to good; moderate seepage.	Poorly stable; use with proper control.	Slow internal drainage.	No problem-----------------	No problem--------	No problem.
Fairly stable to a depth of 25 inches with flat slopes.	Poor; limestone bedrock affects excavation; may seep.	Poorly stable; not desirable for roll-filled construction.	Bedrock at a depth of 2 1/2 feet; slow internal drainage; high dispersion affects deep cuts.	Shallow surface soil; caliche at a depth of 2 feet; bedrock at a depth of 2 1/2 feet.	Bedrock at a depth of 2 1/2 feet.	Shaping affected by bedrock at a depth of 2 1/2 feet.
Very stable to fairly stable with flat slopes.	Excellent-------------------	Stable to fairly stable with flat slopes; use for impervious cores and blankets.	Very slow internal drainage; high dispersion affects deep cuts.	Shallow surface soil affects land leveling; very slow permeability.	Gully erosion; high shrink-swell potential.	Shaping limited by shallow depth of surface soil.
Poorly stable to a depth of 20 inches; below that depth very stable to fairly stable with flat slopes.	Excellent-------------------	Poorly stable to a depth of 20 inches; below that depth stable to fairly stable with flat slopes.	Slow permeability below a depth of 20 inches; high dispersion.	Slow permeability below a depth of 20 inches; depth of surface soil affects land leveling on the stronger slopes.	Gully erosion-----	Poor to fair stability; gully erosion on stronger slopes.
Poor------------------------	Poor------------------------	Poor------------------------	Rapid permeability.	Poor------------------------	Poor--------------	Poor.
Fairly stable; can be used for dikes.	Poor; excessive seepage-----	Fairly stable to poor in stability; can be used with proper control.	Rapid permeability.	Complex slopes; stratification; rapid permeability.	Complex slopes----	Deposition from water; periodic flooding.

samples from 18 profiles, in Haskell County, Tex.[1]

Mechanical analysis: Percentage retained on sieve--: Round opening: No. 4	Square mesh: No. 10 (2.0 mm.)	Square mesh: No. 40 (0.42 mm.)	Square mesh: No. 60 (0.25 mm.)	Square mesh: No. 200 (0.074 mm.)	Percentage larger than--: 0.05 mm.	Percentage larger than--: 0.005 mm.	Percentage larger than--: 0.002 mm.	Specific gravity	Classification: AASHO	Classification: Unified
---------	-----------	1	5	18	21	64	72	2.66	A-7-6	CL.
---------	-----------	2	6	19	22	62	72	2.64	A-7	CL.
---------	-----------	3	10	25	26	50	70	2.70	A-6	CL.
---------	-----------	2	3	18	37	77	85	2.67	A-7-6	CL.
---------	-----------	2	3	13	14	57	70	2.65	A-7-6	CH.
---------	1	10	11	26	28	51	72	2.74	A-7-6	CL.
---------	-----------	-----------	2	8	14	54	61	2.70	A-7-6	CL.
---------	-----------	0	2	8	12	40	52	2.71	A-7-6	CL.
5	9	15	16	21	24	45	59	2.71	A-6	CL.
---------	-----------	1	2	8	11	65	77	2.64	A-7-6	CL.
---------	1	1	3	7	13	64	72	2.69	A-7-6	CL.
---------	-----------	1	2	6	6	35	45	2.68	A-6	CL.
---------	-----------	1	3	12	20	70	82	2.63	A-7-6	CL.
---------	1	2	5	10	16	65	73	2.68	A-7-6	CH.
---------	1	5	6	12	12	40	68	2.71	A-7-6	CL.
---------	-----------	-----------	2	12	22	67	73	2.62	A-6	CL.
---------	-----------	1	3	13	21	53	58	2.65	A-7-6	CH.
---------	5	12	14	24	32	62	68	2.68	A-7-6	CL.

TABLE 6.--*Engineering test data for soil samples*

Soil name and location	Horizon	Depth	Liquid limit	Plasticity index	Field moisture equivalent	Shrinkage limit	Lineal shrinkage	Shrinkage ratio	Soil binder
Miles fine sandy loam, 0 to 1 percent slopes (parent material from outwash)--									
4.7 miles west and 2.5 miles north of Haskell (modal profile):		*Inches*	*Percent*		*Percent*	*Percent*	*Percent*		*Percent*
58-75-R	A_{1p}	0-8	17	3	15	15	1.6	1.80	98
58-76-R	B_1	8-15	27	14	22	16	6.0	1.81	97
58-77-R	B_2	15-39	31	17	20	15	7.9	1.83	98
58-78-R	B_3	39-72	30	16	19	14	7.7	1.85	100
4 miles east-northeast of Rule:									
58-99-R	A_{1p}	0-8	16	3	14	15	.9	1.86	94
58-100-R	B_1	8-15	21	5	17	14	3.8	1.86	93
58-101-R	B_2	15-26	27	13	18	16	6.2	1.82	95
58-102-R	B_3	26-45	21	7	17	15	3.3	1.81	94
5.2 miles north and 2.7 miles west of Weinert:									
58-106-R	A_{1p}	0-8	18	3	17	20	2.0	1.81	98
58-107-R	B_1	8-16	31	15	22	14	8.3	1.84	97
58-108-R	B_2	16-46	33	18	22	14	10.1	1.90	98
58-109-R	B_3	46-72+	30	16	21	17	6.6	1.78	98
Roscoe clay, 0 to 1 percent slopes (parent material from outwash)--									
1.9 miles north and 5.5 miles west of Haskell (modal profile):									
58-82-R	A_{11}	0-19	47	24	32	12	15.9	1.96	99
58-83-R	A_{12}	19-32	48	27	29	11	16.7	1.99	99
58-84-R	C_{ca}	60-72	48	30	27	14	15.1	1.93	94
4.3 miles south and 5 miles north of Haskell:									
58-72-R	A_{12}	5-20	55	31	39	13	17.5	1.90	98
58-73-R	A_{13}	20-40	58	37	34	11	19.5	1.97	98
58-74-R	C_{ca}	54-72+	48	30	27	11	16.9	2.01	100
10.8 miles north of Haskell:									
58-103-R	A_{11}	0-14	49	27	33	13	15.7	1.90	100
58-104-R	A_{12}	14-27	46	27	30	12	15.4	1.97	92
58-105-R	C_{ca}	45-58+	48	28	30	12	16.7	1.97	99
Tillman clay loam, 1 to 3 percent slopes (parent material from Permian red beds)--									
2.9 miles south and 7.9 miles east of Haskell (modal profile):									
58-90-R	B_2	6-22	48	27	29	15	14.6	1.86	97
58-91-R	B_3	22-42	48	28	30	11	17.4	2.05	99
58-92-R	C_{ca}	42-62+	42	23	25	12	14.0	1.98	99
2.4 miles south of Sagerton:									
58-66-R	B_2	6-25	43	24	31	12	14.6	1.96	94
58-67-R	B_3	25-47	40	24	23	13	12.9	1.94	87
58-68-R	C_{ca}	47-72+	42	26	24	10	15.6	2.06	100
2.9 miles east of Haskell:									
58-87-R	B_2	5-26	43	24	26	11	15.2	2.00	96
58-88-R	B_3	26-38	39	22	23	11	14.1	2.02	97
58-89-R	C_{ca}	38-66+	32	19	20	11	10.2	2.04	98
Vernon clay, 3 to 8 percent slopes (parent material from Permian red beds)--									
5 miles east of Haskell (modal profile):									
58-118-R	A_1	0-10	47	24	28	11	16.3	1.99	97
58-119-R	C_1	10-30	48	25	29	11	16.7	2.00	91
5.9 miles south of Haskell:									
58-85-R	A_1	0-6	38	20	24	12	13.0	1.98	94
58-86-R	C_1	6-26	42	23	23	11	15.0	2.05	98
3.3 miles north of Stamford:									
58-113-R	A_1	0-8	49	26	27	12	16.3	1.96	91
58-114-R	C_1	8-30+	39	25	26	13	12.7	1.94	96

[1] Test data supplied by the Texas Highway Testing Laboratory.
[2] 1 percent retained on 3/8-inch sieve.

from 18 profiles, in Haskell County, Tex.[1] --Continued

Mechanical analysis								Specific gravity	Classification	
Percentage retained on sieve--					Percentage larger than--					
Round opening	Square mesh									
No. 4	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.		AASHO	Unified
---------	-----------	2	25	66	73	90	92	2.64	A-4	SM.
---------	-----------	3	22	60	63	78	83	2.65	A-6	SC.
---------	-----------	2	17	52	53	71	75	2.70	A-6	SC.
---------	-----------	0	17	53	54	76	81	2.74	A-6	SC.
---------	2	6	35	73	77	88	89	2.63	A-2-4	SM.
---------	1	7	36	70	72	79	80	2.65	A-2-4	SM-SC.
---------	1	5	24	63	63	71	75	2.68	A-6	SC.
---------	-----------	6	26	69	70	78	79	2.65	A-2-4	SM-SC.
---------	-----------	2	18	60	64	80	82	2.61	A-4	SM.
---------	-----------	3	16	50	52	67	70	2.66	A-6	SC.
---------	-----------	2	13	44	46	64	66	2.66	A-6	CL.
---------	-----------	2	15	54	63	79	80	2.65	A-6	SC.
---------	-----------	1	3	12	18	68	77	2.65	A-7-6	CL.
---------	-----------	1	3	13	16	56	66	2.66	A-7-6	CL.
---------	0	6	11	23	24	50	70	2.73	A-7-6	CL.
---------	-----------	2	3	9	16	55	69	2.66	A-7-6	CH.
---------	-----------	2	3	9	10	54	65	2.66	A-7-6	CH.
---------	-----------	0	3	6	8	43	60	2.64	A-7-6	CL.
---------	-----------	0	1	12	15	33	77	2.70	A-7-6	CL.
---------	-----------	8	11	24	25	52	58	2.76	A-7-6	CL.
---------	-----------	1	3	13	19	36	62	2.67	A-7-6	CL.
0	1	3	4	8	17	67	79	2.65	A-7-6	CL.
---------	-----------	1	2	6	8	48	60	2.68	A-7-6	CL.
---------	1	1	2	6	6	47	62	2.75	A-7-6	CL.
---------	1	6	7	25	32	70	82	2.67	A-7-6	CL.
[2] 4	7	13	15	30	37	67	78	2.70	A-6	CL.
---------	-----------	0	2	16	20	49	67	2.75	A-7-6	CL.
0	1	4	5	11	17	59	70	2.70	A-7-6	CL.
---------	0	3	4	11	11	51	59	2.69	A-6	CL.
---------	1	3	3	11	22	62	75	2.63	A-6	CL.
---------	1	3	4	8	12	40	52	2.76	A-7-6	CL.
1	3	10	12	23	27	54	61	2.79	A-7-6	CL.
[2] 3	4	6	6	10	20	60	72	2.65	A-6	CL.
---------	0	2	2	5	14	50	62	2.75	A-7	CL.
4	5	9	11	18	21	44	53	2.76	A-7-6	CL.
1	2	5	17	42	50	66	72	2.80	A-6	CL.

eliminating tests of material obviously unsuited to a specific use; for locating materials suitable for the type of structure planned; and in helping choose the most favorable location, design, and construction for certain structures of a low-hazard type that normally are built on the basis of general experience in the area. In general, the information presented can be used to:

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of runoff and erosion for use in designing drainage structures, in planning dams, and in planning other structures that will help in conserving soil and water.
3. Make preliminary evaluations of soil and ground conditions that will aid in planning and selecting locations for agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, waterways, highways, airports, reservoirs, or other engineering structures.
4. Locate probable sources of gravel, sand, or other materials needed for use in construction.
5. Correlate performance of engineering structures with soil mapping units and thus develop information that will be useful in designing and maintaining the structures.
6. Determine the suitability of the soil unit for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from published maps, reports, and aerial photographs for the purpose of making soil maps and reports that can be used readily by engineers.
8. Develop preliminary estimates of areas or sites that may require special construction methods or the use of specific design criteria to assure a satisfactory structure.

Some of the terms used by the soil scientist may not be familiar to the engineer; other terms, though familiar, have special meanings in soil science. Most of the terms used in the three tables, and other special terms used in the report, are defined in the Glossary.

Engineering classification systems.--The United States Department of Agriculture system of classifying soil texture is used by agricultural scientists.[3] In some ways this system of classifying soil texture is comparable to the two systems used by engineers for classifying soils. The systems used by engineers are explained briefly as follows:

The American Association of State Highway Officials (AASHO) has developed a classification based on the field performance of soils.[4] In this system soil materials are classified in seven principal groups. The groups range from A-1 (gravelly soils having high bearing capacity) to A-7 (clayey soils having low strength when wet). Within each group the relative engineering value of the material is indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. Most highway engineers classify soils in accordance with the AASHO system. The soils of Haskell County have been classified under this system in table 4.

The Unified system of soil classification was established by the United States Army, Corps of Engineers.[5] It is based on the identification of soils according to their texture and plasticity and on their performance as engineering construction materials. In the Unified system the symbols SM and SC represent sands with fines of silt and clay; ML and CL, silts and clays of low liquid limit; MH and CH, silts and clays that have a high liquid limit; and GP and GM, gravels and gravel-sand mixtures. Some soil materials have characteristics that are in a border zone between the major classes and are given a borderline classification, as CL-CH.

Engineering interpretations and soil test data.--The properties of the soils that affect their use for engineering are summarized in tables 4, 5, and 6.

Table 4 gives brief descriptions of the soils and the physical properties of the major horizons (layers) in typical soil profiles. In most soils the soil profile consists of several significant horizons. The depth of each is given in inches. More complete descriptions of soil profiles are given in the section "Descriptions of Soils." Table 4 also gives classifications by the textural class of the United States Department of Agriculture, estimates of the Unified classification of the material, and the classification used by the American Association of State Highway Officials. The grain size, permeability, structure, available water capacity, reaction, salinity, dispersion, shrink-swell potential, and content of gypsum have been generalized from laboratory tests of some of the soils and estimated for the others.

The column showing permeability in inches per hour gives an estimate of the rate that water percolates through soil material that is not compacted.

The type of soil structure in the major horizons of each typical soil profile is also given in table 4. Soil structure means the arrangement of primary soil particles into clusters, such as granules, blocks, prisms, or other forms that are separated from adjoining masses by surfaces of weakness. The terms used in the column in which structure is described are defined in the Glossary.

The column showing the available water capacity gives the amount of water that the soil can hold, expressed in inches of water per foot of soil depth. It is an approximation of the capillary water in the soil when wet to field capacity. If the soil is air dry, this amount of moisture will wet the soil to a depth of 1 foot without deep percolation.

In the column showing reaction, the intensity of the acidity or alkalinity of the soil is expressed in pH value. A notation of pH 7 is neutral; a value lower than this indicates an acid soil, and a higher value indicates alkalinity.

The ratings in the column on salinity express the concentration of salt. Those ratings designated as

[3] U. S. Department of Agriculture. Soil Survey Manual. Agr. Handb. No. 18, 503 pp., illus. 1951.

[4] American Association of State Highway Officials. Standard Specifications for Highway Materials and Methods of Sampling and Testing; Designation: M 145-49, AASHO; 7th ed., 2 pts., illus. Washington, D. C. 1955.

[5] U. S. Army, Corps of Engineers. The Unified Soil Classification System. Tech. Memo. 3-357, v. 1. 1953.

"low" contain less than 0.15 percent of soluble salts; more than this amount generally has a harmful effect on crops.

The ratings in the column on dispersion give the degree and rapidity with which the soil material slakes in water and the soil structure breaks down. Dispersion is expressed in terms of "high," "moderate," and "low." An easily dispersed soil seals over and resists penetration of water, roots, and air; it is readily eroded by wind and water.

The ratings for shrink-swell potential indicate volume change; that is, the shrinking of the soil when it dries and the swelling of the soil as it takes up moisture. In general, soils classed as CH or A-7 have a high or very high shrink-swell potential and soils classed as SP or SM have a low shrink-swell potential.

Table 5 describes characteristics of the soils that affect the design of structures and application of construction measures. The table shows estimates of the suitability of the soil material for highway construction and for dikes or levees, farm ponds, terraces, and waterways. It also gives the characteristics that affect the suitability of the soils for drainage or irrigation. The data are based on the interpretation of characteristics given in table 4, on actual test data from table 6, and on field experience and performance.

Table 6 gives the engineering test data for soil samples taken from 18 profiles of 6 soil series. These samples were taken in the county. The laboratory tests were made by the Texas State Highway Department Testing Laboratory.

The engineering soil classifications in table 6 are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. Mechanical analyses were made by combined sieve and hydrometer methods. Percentages of clay, obtained in this test by the hydrometer method, are not suitable for determining USDA textural classes of soils.

The tests for liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content, on a dry basis, at which the soil material changes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material changes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

Field moisture equivalent is the minimum moisture content at which a smooth surface of soil in its natural state will absorb no more water in 30 seconds when the water is added in individual drops. It is the moisture content required to fill all the pores in sands and to approach saturation in cohesive soils in their natural state.

As moisture leaves a soil, the soil shrinks and decreases in volume in proportion to the loss in moisture until a condition of equilibrium is reached where shrinkage stops although additional moisture is removed. This point of moisture content where shrinkage stops is called the shrinkage limit of the soil and is reported as the moisture content, in relation to ovendry weight of soil, at the time when shrinkage stops.

Since clay is the major soil fraction that causes shrinkage, the shrinkage limit of a soil is a general index of clay content and will, in general, be low in soils that contain a great deal of clay. The shrinkage limit of a sand that contains little or no clay is close to the liquid limit and is called insignificant. Sands containing some silt and clay have a shrinkage limit of about 14 to 25, and the shrinkage limit of clays ranges from about 9 to 14. The load-carrying capacity of a soil is at a maximum when the moisture content is at or below the shrinkage limit. Sands do not follow this rule because they will have a uniform load-carrying capacity with a considerable range in moisture content, providing they are confined.

Lineal shrinkage is the decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from the stipulated percentage to the shrinkage limit.

The shrinkage ratio of a soil is the ratio between its volume change and the corresponding change in water content above the shrinkage limit. Theoretically, the shrinkage ratio is also the apparent specific gravity of the dried soil pat.

The mechanical analysis gives the soil components by particle size classes. Percentages are those retained on a sieve of the size stated, or larger than the limits in diameter of the fine particles that are stated as fractions of a millimeter.

Formation and Classification of Soils

In this section the factors that have affected the development and composition of the soils of Haskell County are discussed. Also discussed is the classification of the soils by higher categories. Physical and chemical data are limited for these soils. Therefore, the discussion of how the soils formed and are classified is correspondingly incomplete.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent materials, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief or lay of the land, and (5) the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are active factors of soil formation. They act on the parent material accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation

are conditioned by relief. The parent material also affects the kind of profile that can be formed and in extreme cases determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. The amount of time may be much or little, but, generally, a long time is required for distinct horizons to develop in a soil.

The individual factors of soil formation are discussed separately in the paragraphs that follow. It is the interaction of all of these factors, however, that determines the nature of the soil profile. The interrelationship among the five factors is complex, and the effects of any one factor are difficult to isolate. In some areas the effects of four of the factors are constant, or nearly so, and the effects of the fifth factor can be partially evaluated. Even in these areas, however, an appraisal of the effects is only an approximation.

Parent materials

The parent materials from which the soils of Haskell County developed are from five different geological formations or groups--the Clear Fork, Double Mountain, Wichita, Seymour, and Recent. The formations vary greatly and may consist of limestone, consolidated clay and shale, unconsolidated loamy and clayey materials, or alluvium.

The Clear Fork and Double Mountain groups are part of the Permian red beds.[6] The Wichita group is also of the Permian period and is made up of several formations. Except for the Leuders formation, all of the formations of the Wichita group are east of Haskell County. The Leuders formation, which is composed of limestone and shale, underlies the southeastern corner of the county. The Byrds, Tarrant, and Valera soils have developed in materials from this formation (fig. 11). They are very crumbly, clayey soils or are stony.

The Clear Fork group extends westward from the Wichita group to the Double Mountain group and north to the Seymour deposits. The Clear Fork group is made up of three formations, all of which are exposed in Haskell County. These formations consist mainly of red shale and clay, but they include sandstone, marl, gypsum, and thin strata of limestone. The Foard, Hollister, Owens, Stamford, Tillman, and Vernon soils have developed in materials from these formations (fig. 12). Except for the Hollister soils, all of these soils consist of tight

[6] Sellards, E. H., Adkins, W. S., and Plummer, F. B. The Geology of Texas. Univ. Tex. Bul. 3232, v. 1. 1007 pp., illus. 1932.

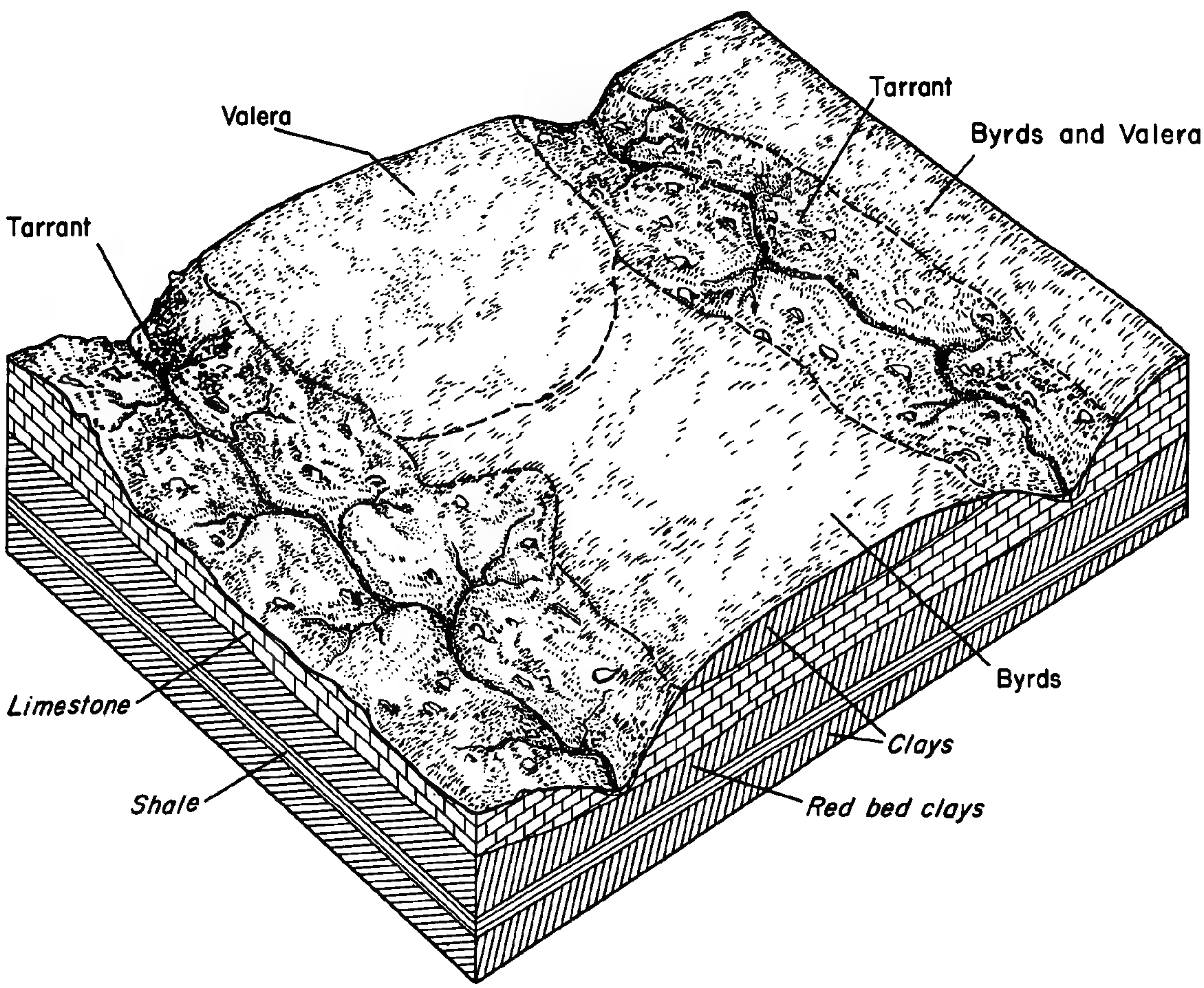

Figure 11.—Soils developed over limestone.

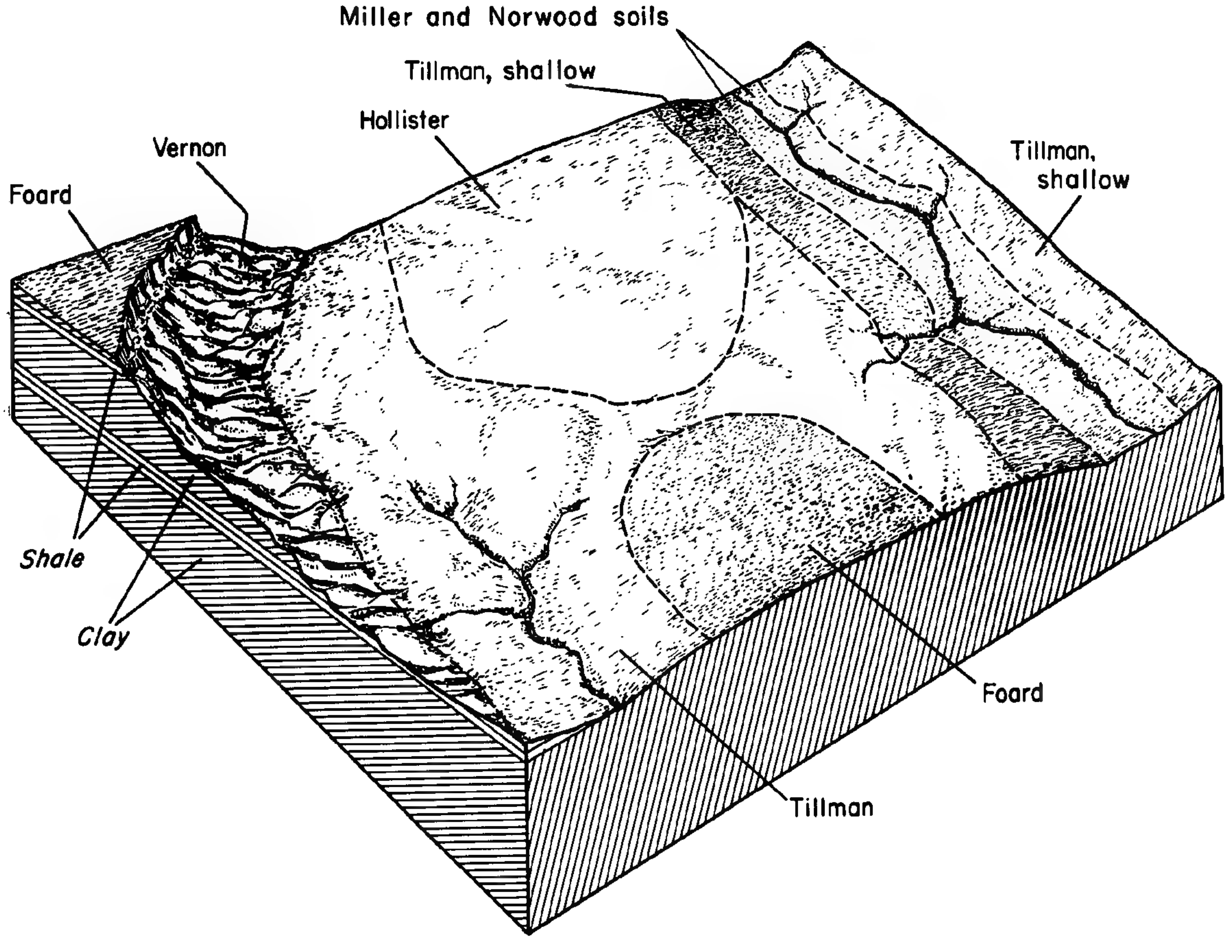

Figure 12.—Soils developed in red-bed clay and shale.

clay throughout and have a pan or are very shallow, heavy clays.

The Double Mountain group is in the extreme western part of the county, south of the Double Mountain Fork of the Brazos River. This group contains several formations consisting of dolomite, sand, sandstone, shale, and gypsum. The Cottonwood soil is the only soil recognized in Haskell County that developed in material from this group. This soil is very shallow over gypsum.

The Seymour deposits are of Quaternary (Pleistocene) age. These deposits form a mantle that ranges from a few feet to 50 feet in thickness. The deposits cover the northwestern part of the county and extend into the eastern part, where they cover the ridges. Islands or remnants occur in the southern part of the county. The sediments consist of unconsolidated materials, mainly of sand and sandy clay, that were laid down as stream terraces or interstream deposits. Soils developed in these deposits are crumbly and porous.

The Abilene, Drake, Enterprise, Mansker, Miles, Portales, Randall, Roscoe, Springer, and Wichita soils developed in materials from the Seymour deposits (fig. 13). Of these, the Drake soils occur on low dunes and have developed in eolian materials blown from playas. The Enterprise, Miles, and Springer soils are sandy and have been reworked to some extent by wind. The Enterprise soils probably developed in eolian material blown from the bottom lands of the Brazos River. The Portales soils have been recalcified by a high water table, but they are now well drained. The Randall soils developed under wetter conditions than the other soils that formed in material from the Seymour deposits. They occur on the floors of lakes and receive extra water from surrounding areas.

The soils of Recent age are on the present-day flood plains. These soils are in the Miller, Norwood, Spur, and Yahola series. The alluvial land types are also of Recent age.

Climate

Haskell County has a subhumid, warm-temperate, continental climate typical of the climate throughout the Rolling Plains. Summers are hot; winters are moderate, but severe cold spells sometimes occur. The annual rainfall is low. Generally, rains are of high intensity so that much of the water is lost through runoff. The wind and high temperatures also cause much of the water to evaporate. Little water moves through the soils, and the basic elements are not leached out.

The soils developed in materials from red beds absorb water very slowly. These soils are tight

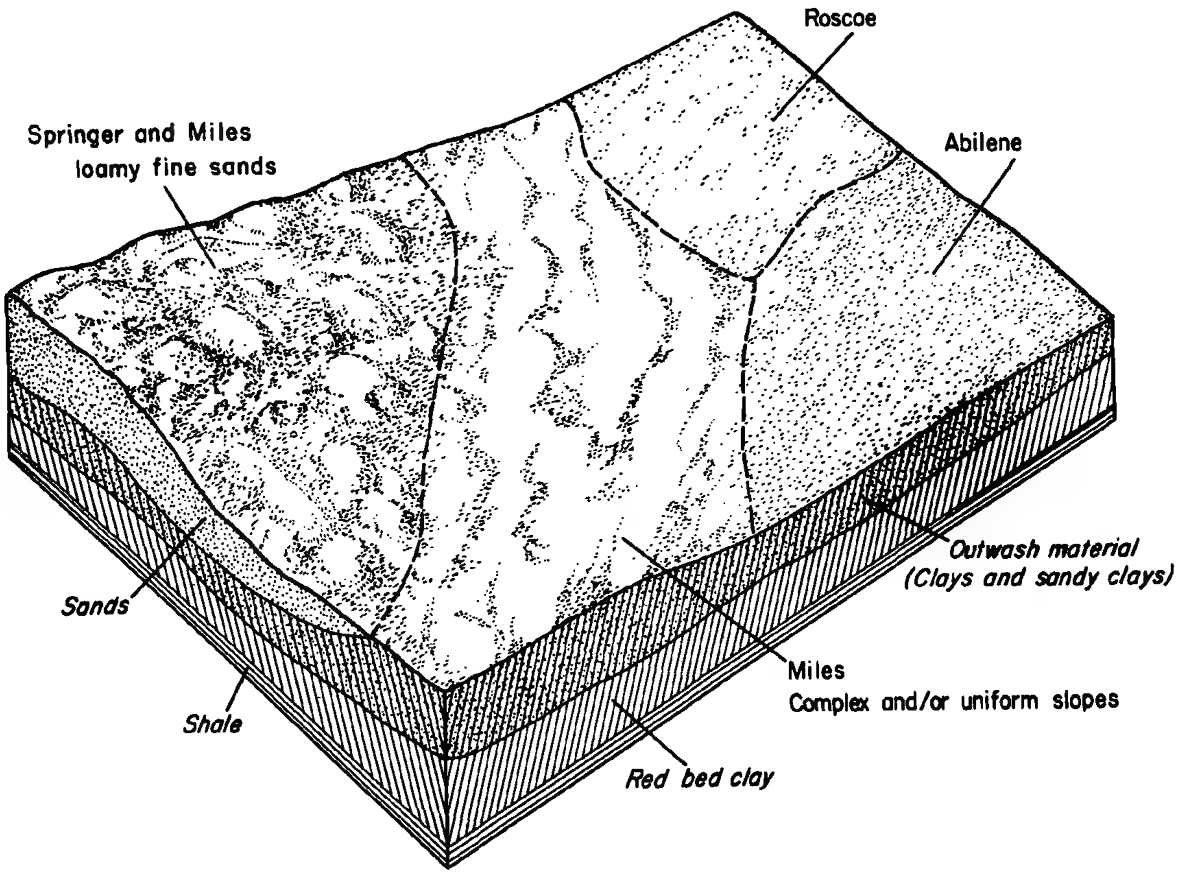

Figure 13.—Soils developed in outwash material of Pleistocene age.

and are on gentle to moderately strong slopes. The soils developed in materials from other formations absorb a larger amount of water and at a faster rate. They generally are less sloping than the soils developed in materials from the red beds and are more crumbly and porous than those soils.

Plant and animal life

Plants, micro-organisms, earthworms, and other forms of life that live on or in the soil are active in soil-forming processes. They help decompose plant residues; they also affect the chemistry of the soil and hasten soil development. Living organisms also help to convert plant nutrients to a form that is more readily available to higher forms of plant life.

Vegetation provides shade and thus reduces losses of water from runoff, wind, and heat. It adds organic matter to the soil, thereby influencing the structure and physical condition of the soil. The plant roots help to keep the soil supplied with minerals by bringing elements from the parent material to the surface soil in a form more usable to plants. In Haskell County the native vegetation under which the soils developed consisted of grasses.

Relief

In this county relief ranges from level to steep. Generally, more water from rainfall runs off the strongly sloping soils than off the gently sloping ones, and its velocity is more rapid. On some steep areas much water runs off; consequently, geologic erosion keeps almost even pace with the weathering of the rocks and with the formation of soils. In such steep areas soil materials do not remain in place long enough for a profile with genetically related horizons to form. Conversely, in level areas the soils generally absorb more of the water that falls and there is likely to be little erosion. Depressions, or concave areas, receive extra water through runoff from adjacent slopes, and in these areas the soils may be wet for long periods. This wetness affects the rate of horizon development.

Thus, through its general influence on runoff and drainage, relief inhibits some processes of horizon differentiation and favors others. Unlike profiles are therefore formed from parent materials that are of the same kind but in different positions within the same landscape. Commonly, relief is a local factor rather than a regional factor in soil formation.

The distinctness of horizons within a soil profile and the total thickness of the solum are closely related to relief. Generally, soils that have a thick solum and distinct horizons occur on gentle slopes; soils on stronger slopes have less distinct horizons and a thinner solum. In level or nearly level areas, the soils generally are dense, slowly permeable, and poorly drained. Sandy, permeable soils, however,

are well drained, even though they are level or nearly level.

Time

Time is required for the formation of a mature soil from the parent material. Generally, the age of a soil is reflected in the distinctness of the horizons in its profile. The length of time required for a soil to develop depends on the combined action of the soil-forming factors. If the factors of soil formation have not operated long enough for definite horizons to have formed, the soil is considered young, or immature. Soils that have been in place for a long time and that have approached equilibrium with their environment tend to have well-expressed horizons and are considered mature. Time has had little effect upon the soils of Haskell County.

In the uplands of the county, the parent materials have been in place for a long time. They likely have been exposed to weathering and soils have been in the process of forming throughout all of the Recent period and during part of the Pleistocene period. Some of the soils are older than others, but differences among them have resulted largely from differences in the kind of parent material and relief.

On the flood plains the sediments in which the soils are forming are of recent geological origin. The sediments have not been in place long enough for soils to have formed distinct horizons. Consequently, the Alluvial soils are younger than the other soils in the county.

Classification of Soils

Soils are classified in various categories to show their relationship to one another. The lowest units of classification--the series and type--are defined in the Glossary and are discussed in the section "Descriptions of Soils."

Soil series are classified into the next higher category, the great soil group. Each great soil group is made up of soils that have the same general kind of profile but that differ in kind of parent material, in relief, or in degree of development. The broadest categories of soil classification are the three soil orders--zonal, intrazonal, and azonal. All three orders are represented in this county.

To help the reader understand the genetic relationship of the soils in Haskell County, the soil series are classified by order and great soil group in the list that follows:

ZONAL SOIL ORDER:
- Chestnut soils--
  - Abilene.
  - Altus.
  - Foard.
  - Hollister.
  - Tipton.
- Reddish Chestnut soils--
  - Miles.
  - Tillman.
  - Wichita.
- Reddish Brown soils--
  - Springer.

INTRAZONAL SOIL ORDER:
- Grumusols--
  - Byrds.
  - Randall.
  - Roscoe.
  - Valera.[1]
- Calcisols--
  - Mansker.
  - Portales.

AZONAL SOIL ORDER:
- Alluvial soils--
  - Miller.
  - Norwood.
  - Spur.
  - Yahola.
- Lithosols--
  - Cottonwood.
  - Owens.
  - Tarrant.
  - Vernon.
- Regosols--
  - Drake.
  - Enterprise.
  - Stamford.

[1] The Valera series is classified here with the Grumusol group. Soils included in the series, however, include some with certain characteristics of other great soil groups.

Additional Facts About the County

In this section the settlement, climate, water supply, and agriculture of Haskell County are discussed. Facts are also given about transportation and markets, industries, and community facilities. The statistics in the subsection "Agriculture" are mainly from reports of the U. S. Bureau of the Census.

Settlement

Indians roamed and hunted in the area that is now Haskell County during the time the early settlements were being established. Settlers began to come to the area in the late 1870's. Most of them were cattlemen who came from East Texas, but a few came from the eastern part of the United States. The county was formed in 1858 and was organized in 1885.

The early settlers grazed their cattle on the open range. Then, in about 1900, the settlers began to plow the rangeland and to plant it to crops. Soon after that, much of the rangeland was plowed, and the area was rapidly put into cultivation.

Climate

Haskell County has a subhumid, continental climate. The average annual precipitation is low and is irregularly distributed throughout the season. Rainfall is erratic from year to year. Summers are hot, and the rate of evaporation is high. Winters are moderate, but there are occasional spells of severe cold weather. Table 7, compiled from records of the weather station at Haskell, gives climatic data representative of the county.

TABLE 7.--*Temperature and precipitation at Haskell, Tex.*

[Elevation, 1,553 feet]

Month	Temperature[1]			Precipitation[2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1956)	Wettest year (1941)	Average snowfall
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December......	44	84	-3	1.09	1.00	1.61	0.8
January.......	43	89	-3	.81	.50	.37	1.8
February......	46	94	-3	1.08	.90	3.96	1.0
Winter......	44	94	-3	2.98	2.40	5.94	3.6
March.........	54	101	5	1.05	.15	1.84	.4
April.........	64	106	24	2.43	.65	5.06	([3])
May...........	76	108	34	3.66	3.65	8.57	0
Spring......	65	108	5	7.14	4.45	15.47	.4
June..........	80	113	46	3.09	0	4.72	0
July..........	82	115	54	2.10	.60	2.03	0
August........	84	115	49	2.00	1.25	5.42	0
Summer......	82	115	46	7.19	1.85	12.17	0
September.....	76	107	36	2.42	0	2.56	0
October.......	65	101	22	2.42	1.35	3.59	0
November......	53	91	9	1.36	.21	.97	.2
Fall........	65	107	9	6.20	1.56	7.12	.2
Year......	64	115	-3	23.51	10.26	40.70	4.2

[1] Average temperature based on a 55-year record, through 1955; highest and lowest temperatures on a 55-year record, through 1955.

[2] Average precipitation based on a 57-year record, through 1957; wettest and driest years based on a 57-year record, in the period 1900-1957; snowfall, based on a 50-year record, through 1952.

[3] Trace.

The average annual rainfall in the county (fig. 14) is about 24 inches, but nearly 41 inches fell in 1941, and only about 10 inches, in 1956. About two-thirds of the total rainfall comes during the growing season. Many of the rains are of high intensity. As a result, much of the water is lost through runoff.

Gentle breezes usually blow in summer. From December through May, gusty winds blow occasionally from the south, west, or north. These winds often damage soils in unprotected fields. "Northers"--the winds that come from the north or northwest--are generally cold. They sometimes cause the temperature to drop below freezing, although subzero temperatures are rare. Snow is common, but a heavy snowfall is unusual. Late in spring and in summer, hailstorms occasionally damage crops or destroy them; these storms are not widespread.

The length of the average growing season at Haskell is 226 days. The average date of the last frost in spring is March 29, and the average date of the first in fall is November 10. The growing season is long enough for cotton, the main cash crop, to mature. Sometimes the period of high rainfall in May coincides with the planting season for cotton and causes planting to be delayed. If the delay is long and planting is unusually late, the cotton is likely to be killed by early frosts before it matures. Generally, cotton can be planted safely as late as June 30.

The annual average rate of evaporation is high. About 70 inches of water will evaporate from an open tank of water during a year. The relative humidity is moderate. It is in the high sixties in winter and in the low fifties in summer.

Water Supply

Except for the Clear and Double Mountain Forks of the Brazos River, which flow most of the year and have waterholes the year round, the streams in Haskell County are intermittent. Most of the water supply in the county comes from wells. Wells provide water for the towns of Haskell, Rule, and Rochester. The town of Stamford, however, obtains water from Lake Stamford, an artificial lake covering about 5,000 acres.

Where water from wells is not available, water for household use is often obtained from underground cisterns that are used to collect and store rainwater. In some places water is hauled from the towns where there are wells. Livestock generally drink runoff water that has accumulated in ponds or tanks.

Most of the areas where the supply of water is sufficient for supplemental irrigation are in the northwestern part of the county. Water for irrigation is obtained from strata of sand and gravel that underlie the Seymour deposits. These strata are immediately above the Permian red beds.

Irrigation is fairly new in the county. It began as the result of a period of drought, which struck the county in 1951. In 1952, only 15 inches of rainfall was recorded. Less than 4 inches of this fell during the growing season.

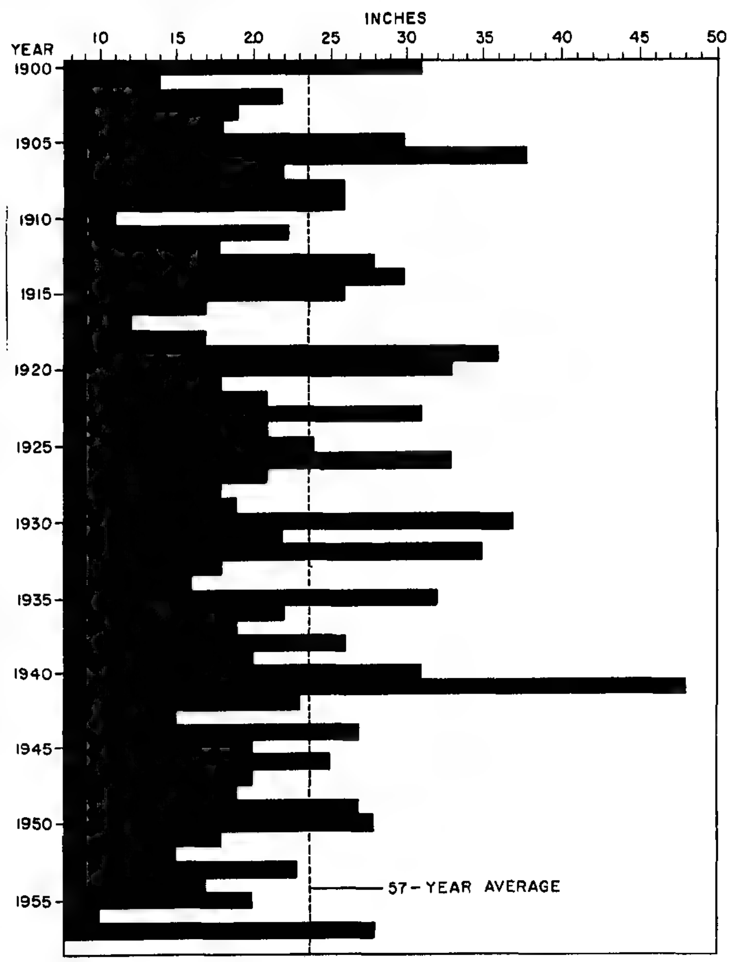

Figure 14.—Annual rainfall in Haskell County from 1900 to 1958.

When the drought became severe, a few cotton farmers remembered that drillers, attempting to locate oil, had reached water in underground strata northwest of Haskell. The farmers drilled for water in the spring of 1952. Most of them located a large enough supply so that they could irrigate their cotton and thus supplement the meager rainfall. The farmers who irrigated obtained yields well above the average for the county. As a result, the number of irrigation wells increased as the drought continued until, at the close of 1956, there were 465 wells. In that year 10,000 acres was irrigated. The wells yield from 60 to 1,000 gallons a minute, but the average yield is about 250 to 300 gallons a minute. Depth to water ranges from about 35 to 60 feet.

Agriculture

Haskell County changed rapidly from open range to cropland after farming began in 1900. The sandy soils in the northeastern part of the county were the first to be used for farming. By 1919, crops occupied only about 40 percent of the acreage in the county. By 1954, however, crops occupied about 60 percent, or 526,171 acres, and there were 1,330 farms in the county. The farms averaged 396 acres in size.

Even though the changeover from grazing to growing crops was rapid after 1900, the number of cattle raised in the county stayed about the same. Little of the land reverted to range after it had once been plowed. Most of the acreage that reverted to range consisted of loamy sands. The county has no woodlands.

About 75 to 95 percent of the cultivated acreage in the county is in row crops--mainly cotton and sorghum. The principal drilled crops are wheat and oats grown as feed for livestock. The wheat and oats can be grazed in winter and early in spring when most grasses are dormant and will still produce a crop of grain.

Crops

The number of crops that can be grown successfully in the county is limited by the small amount of rainfall. Cotton and sorghum are the main crops. In some years they occupy as much as 95 percent of the cropland. Wheat, oats, and minor crops are grown on the remaining acreage. Because cotton is grown each year on more than half of the acreage under cultivation, crop rotations are limited. To obtain enough moisture for crops, some farmers plant two to four rows to crops and keep two to four rows out of cultivation. Many farmers now plant grasses as a crop. The principal grasses planted are sorghum almum and blue panicum. The acreage of the principal crops in stated years is given in table 8.

In the early 1930's all-purpose farm tractors replaced most of the horses and mules as a source of power. Now, most farming operations are done by machinery. Much of the farmland is suited to 2- and 4-row equipment. Most farmers who grow wheat and oats use wheatland tractors. A few farmers have their own combines, but a large part of the wheat, oats, and grain sorghum is custom combined. Most of the cotton is harvested by hand, but cotton strippers are used for the last picking.

TABLE 8.--*Acreage of principal crops*

Crop	1939	1944	1949	1954
	Acres	*Acres*	*Acres*	*Acres*
Cotton	100,421	97,838	172,721	128,889
Sorghum, harvested for grain	46,834	92,168	29,147	66,109
Sorghum, harvested for fodder, hay, or silage	29,236	24,827	9,306	17,255
Wheat, threshed or combined	3,777	31,276	78,324	44,881
Oats, threshed or combined	854	16,756	3,772	17,264

Livestock and livestock products

Table 9 gives the number of livestock in the county in stated years. Almost all of the income from livestock and livestock products is derived from the sale of beef cattle. The number of cattle in the county has remained fairly steady, even though the acreage used for range has decreased. About eight ranches in the county, or partly in the county, depend almost entirely upon native grass to provide forage for their cattle. Many other ranchers supplement their supply of grass by allowing the cattle to graze on small grain late in winter and early in spring. They remove the cattle from the fields early enough so that the grain will produce a crop of seed. Nearly all of the cattle are sold outside of the county.

TABLE 9.--*Number of livestock*

Livestock	1940	1945	1950	1954
Cattle and calves	[1] 21,733	35,468	26,927	22,052
Hogs and pigs	[2] 4,528	5,028	3,169	1,753
Sheep and lambs	[3] 4,529	12,710	435	200
Goats and kids	[2] 160	23	45	196
Chickens[2]	181,098	234,186	101,486	57,450

[1] More than 3 months old. [2] More than 4 months old. [3] More than 6 months old.

Dairying is not important in the county, but there are two small herds of dairy cattle. Even the family milk cow is disappearing from the farm.

Sheep and goats are few. Hogs, once common on nearly every farm, are rapidly decreasing in number. A few farmers have from 30 to 50 head of hogs.

The farm poultry flock is also disappearing. Since 1956, however, a few farmers have gone into the poultry business and now have large flocks. There were 16 of these large flocks at the close of 1958.

A few of the horses still in the county are used on ranches. Others are raised as a hobby or for recreation.

Farm tenure and farm facilities

In 1954, 734 farms, or 55 percent of the total number of farms in the county, were operated by owners. Of the remaining farms, 579 were operated by tenants on a sharecrop basis, 14 were operated by cash tenants, and 3 were operated by farm managers. The proportion of farms operated by tenants has steadily decreased since 1935, when only 30 percent of the farms was operated by owners and 70 percent was operated by sharecroppers.

Most of the operators who own their own farms keep their farmsteads neat and their buildings in good repair. Nearly all of these farms are equipped with modern conveniences. Many of the farmsteads occupied by tenants lack modern conveniences and have no facilities to house farm equipment. In 1954, there were 2,174 tractors in the county; 1,290 of the farms had electricity; and 240 had telephones. In 1957, however, telephone service was extended to many parts of the county. Nearly all of the homes use butane or propane gas for cooking. On all farms seasonal labor is hired to help with the work.

The trend is toward larger farm units. More and more farmers are moving to town. They then commute to their farms.

Transportation and markets

The first railroad was built in the county in 1906. Now, railroads, trucklines, and buslines serve all of the towns. Main highways cross the county from north to south and from east to west. Each farm is within a few miles of a paved farm-to-market road. Many of the remaining county roads are graveled. Only a few of the ungraveled roads are unsuitable for use in wet weather.

Farm products are collected in local warehouses. Here, buyers purchase the products and then ship them to markets outside the county.

Industries

The principal industries in the county are associated with the extraction of crude oil. Supplying and servicing the oilfields and servicing the pipelines are among industries connected with the extraction of crude oil. In addition, a cotton compress and a mill where oil is extracted from cottonseed are located in the county. Cotton gins and grain elevators are in all of the towns and larger communities.

Community Facilities

Except for the schools at Paint Creek and Mattson, all rural schools have been consolidated with schools in the towns. The facilities in all of the schools are good.

Churches of nearly all denominations are located in the county. Most of the churches are now in the towns; only a few rural churches remain.

Haskell County Hospital is in the town of Haskell. A medical clinic is located in Rule.

Recreational facilities are provided by Stamford Lake, which is used by sportsmen for fishing. This lake is also used for boating and water skiing. Many farmers and ranchers have stocked the ponds and tanks that provide water for livestock with fish for private fishing. Generally, there are numerous doves and quail for hunters.

Glossary

Aggregate, soil. Many fine soil particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alkaline soil. Any soil that is alkaline throughout most or all of the parts occupied by plant roots but that is not calcareous and does not contain free lime. (See also Reaction.)

Blowing season. The time of the year, January through May, when the soil is the most likely to be damaged by wind erosion; most of the erosion occurs in March and April.

Calcareous soil. A soil containing enough calcium carbonate, often with magnesium carbonate, to effervesce (fizz) when treated with dilute hydrochloric acid.

Caliche. A broad term for more or less strongly cemented accumulations of calcium carbonate in many soils of warm-temperate areas; when near the surface or exposed by erosion, the material hardens.

Clay. (1) As a soil separate, mineral soil particles less than 0.002 millimeter (0.000079 inch) in diameter. (2) As a soil textural class, soil material that contains 40 percent or more clay, as defined under (1), less than 45 percent sand, and less than 40 percent silt. (3) In engineering, fine-grained soil particles that are smaller than 0.005 millimeter.

Claypan. A compact, slowly permeable, clayey soil horizon just below the upper part of the soil. A claypan is commonly hard when dry and plastic and stiff when wet.

Complex, soil. An intricate mixture of areas of different kinds of soil that are too small to be shown separately on a map of the scale used and that are, therefore, mapped as a unit.

Concave slope. The term applied to land surfaces that are carved like the interior of a hollow sphere. In level areas concave spots may be dished or swalelike.

Concretions. Rounded and hardened concentrations of chemical compounds, such as calcium carbonate or iron oxides, often formed as concentric rings about a central particle, in the form of hard grains, pellets, or nodules of various sizes, shapes, and colors.

Consistence, soil. The combination of properties of soil material that determine its resistance to crushing and its ability to be molded or changed in shape. Consistence varies with differences in moisture content; thus, a soil aggregate or clod may be hard when dry and plastic when wet. Terms used to describe consistence are:

Friable. When moist, crushes easily under moderate pressure between thumb and forefinger and coheres when pressed together. Friable soils are easily tilled.

Firm. When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable. Firm soils are likely to be difficult to till.

Hard. When dry, is moderately resistant to pressure; can be broken in the hands without difficulty but is barely breakable between thumb and forefinger.

Indurated. Hard and brittle and little affected by moistening.

Loose. Noncoherent when moist or dry. Loose soils are generally coarse textured and are easily tilled.

Plastic. When wet, retains an impressed shape but is readily deformed by moderate pressure; wire formable. Plastic soils are high in clay and are difficult to till.

Sticky. When wet, adheres to thumb and forefinger when pressed; usually, very cohesive when dry.

Soft. Weakly coherent and fragile; when dry, breaks to powder or individual grains under slight pressure.

Crop residue. That part of a crop, such as stubble, stalks, and leaves, that is left in the field after the crop has been harvested.

Droughty soil. A soil that holds only a small amount of water available to plants. Some soils hold large amounts of water but do not release it to plants; others lose the water through the soil.

Flat slope. Slope of 3 to 1 percent or less.

Friable. See Consistence.

Gilgai microrelief. Consists of small pits, 2 to 6 feet across and 4 to 15 inches deep, in the surface of a soil; typically occurs in soils that have great expanding and shrinking characteristics upon wetting and drying.

Gravel. A soil separate having rounded or angular fragments as much as 3 inches in diameter. The content of gravel is not used in determining the textural class of the soil, but, if the soil contains 20 percent or more gravel, the word gravelly is added as a prefix to the textural soil name. In engineering, a coarse-grained soil of which more than 50 percent is retained on a No. 4 screen.

Hummocky. Topography that is irregular or choppy; has small dunes or mounds that are 3 to 10 feet high with side slopes of 3 to 8 percent.

Miscellaneous land type. Recent, mixed stream deposits or rough, stony, or severely gullied lands that have little true soil; they are identified by descriptive names.

Noncalcareous. As used in this report, a soil that is alkaline but that does not contain enough free lime to effervesce with hydrochloric acid.

Outwash material. A mantle of soil material, a few feet to 60 feet or more thick, that was washed from areas in the High Plains and Rocky Mountains by streams of melt water and deposited on the Permian red beds during glacial times.

Parent material. The unconsolidated mass of rock material (or peat) from which the soil profile develops.

Permeability soil. The quality of a soil horizon that enables water or air to move through it.

Phase, soil. The subdivision of a soil type covering variations within the type not great enough to justify establishing a new type but significant to the use and management of the soil. Examples of the variations recognized by phases of soil types include differences in slope, stoniness, or thickness as the result of accelerated erosion.

Playa. A flat-bottomed, undrained basin or lakebed that contains water for varying periods following rains. Many are dry for long periods and are farmed.

Plowpan. A compacted layer formed in the soil just below plow depth; packing by farm machinery causes this layer.

Poorly graded soils (engineering). Coarse-grained soils with soil particles of fairly uniform size.

Reaction, soil. The degree of acidity or alkalinity of the soil mass expressed in pH values or in words as follows:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5-5.0
Strongly acid	5.1-5.5
Medium acid	5.6-6.0
Slightly acid	6.1-6.5
Neutral	6.6-7.3
Mildly alkaline	7.4-7.8
Moderately alkaline	7.9-8.4
Strongly alkaline	8.5-9.0
Very strongly alkaline	9.1 and higher.

Sand. (1) Individual rock or mineral fragments that have diameters ranging from 0.05 millimeter (0.002 inch) to 2.0 millimeters (0.079 inch). Sand grains consist chiefly of quartz, but they may be of any mineral composition. (2) The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay. (3) In engineering, a coarse-grained soil of which more than 50 percent passes through a No. 4 screen.

Series, soil. A group of soils having the same profile characteristics and the same general range in color, structure, consistence, and sequence of horizons; the same general conditions of relief and drainage; and, usually, a common or similar origin and mode of formation. A group of soil types closely similar in all respects, except for the texture of the surface soil.

Silt. (1) Individual mineral particles that range in diameter from the upper size of clay, 0.002 millimeter, to the lower size of very fine sand, 0.05 millimeter. (2) Soil of the textural class called silt contains 80 percent or more of silt and less than 12 percent of clay. (3) In engineering, fine-grained soil particles that are larger than 0.005 millimeter in diameter.

Soil. The natural medium for the growth of plants on the surface of the earth; composed of organic and mineral materials.

Soil-improving crop. Legumes or fertilized, nonleguminous crops that are grown for the purpose of improving the soil.

Soil separate. The individual size groups of mineral soil particles, as sand, silt, and clay; ordinarily does not include particles larger than 2.0 millimeters in diameter.

Structure, soil. The arrangement of individual soil particles into aggregates with definite shape or pattern. Structure is described in terms of class, grade, and type.

Class. Refers to the size of soil aggregates (fine, medium, and coarse).

Grade. The degree of distinctness and durability of soil aggregates. Grade is expressed as weak, moderate, or strong. Soil that is structureless,

or that has no visible structure is termed massive if coherent or single grain if noncoherent.

Type. Shape and arrangement of the aggregates.

Blocky, angular. Aggregates are block shaped; they have flat or rounded surfaces that join at sharp angles.

Blocky, subangular. Aggregates have some rounded and some plane surfaces; vertices are rounded.

Columnar. Aggregates are prismatic and are rounded at the upper ends.

Crumb. Generally, soft, small, porous aggregates, irregular, but tending toward a spherical shape, as in the A_1 horizon of many soils. Crumb structure is closely related to granular structure.

Granular. Roughly spherical or rounded, firm, small peds that may be either hard or soft but that are usually more firm than crumb and without the distinct faces of blocky peds.

Platy. Soil particles arranged around a plane that normally is horizontal.

Prismatic. Soil particles arranged around a vertical line; aggregates have fairly flat vertical surfaces.

Stubble mulching. Maintaining a protective cover by leaving residues of a crop as a mulch on the surface of the soil until time to seed the next crop. This protects the soil from hot sun, packing rains, and erosion.

Subsoil. The B horizon of soils that have distinct profiles. In soils that have weak profile development, the soil below the plow layer (or its equivalent of surface soil) in which roots normally grow. In normal soils the subsoil is the zone of maximum clay accumulation. In soils that are young--steeply sloping or alluvial soils--it is a layer similar to the plow layer in appearance but generally lighter in color.

Texture, soil. The relative proportions of sand, silt, and clay in the soil. (See Sand; Silt; Clay.)

Topsoil (engineering). Soil material containing organic matter and suitable as a surfacing for shoulders or slopes.

Type, soil. Soils that are similar in kind, thickness, and arrangement of soil layers and that have the same texture in the surface layers are classified as one soil type.

Water-holding capacity. The capacity (or ability) of a soil to hold water, often expressed in inches of water per foot depth of soil.

Well-graded soils. Coarse-grained soils that vary widely in size of particles.

Wilting coefficient (soils). The moisture, in percentage of dry weight, remaining in the soil when plants reach a condition of permanent wilting. (Plants will not revive when placed in a saturated atmosphere.) Also known as wilting point.

Map symbol	Soil name	Soil profile	
		Surface soil	Subsoil
AcA	Abilene clay loam, 0 to 1 percent slopes	Dark grayish-brown, crumbly, noncalcareous clay loam, 6 to 12 inches thick.	Very dark grayish-brown, crumbly clay in uppermost 8 inches; dark grayish-brown, calcareous, sticky clay below.
AcB	Abilene clay loam, 1 to 3 percent slopes	Same	Same
AcB2	Abilene clay loam, 1 to 3 percent slopes, eroded.	Same	Same
AdA	Abilene loam, 0 to 1 percent slopes	Brown, friable loam, 4 to 10 inches thick	Same, except upper part lighter colored
AdB	Abilene loam, 1 to 3 percent slopes	Brown, friable loam, 4 to 10 inches thick	Same, except upper part lighter colored
Ae	Abilene-Miles complex	Same as surface soil of Abilene loams and Miles fine sandy loams.	Same as subsoil of Abilene loams and Miles fine sandy loams.
Al	Alluvial land	Brownish, calcareous, sandy alluvial material	Brownish, calcareous, sandy, but stratified, alluvial material.
At	Altus loamy fine sand	Brown, very friable loamy fine sand, 18 to 34 inches thick.	Same as subsoil in Abilene clay loams
BcA	Byrds clay, 0 to 1 percent slopes	Reddish-brown, noncalcareous, sticky clay, 8 to 15 inches thick.	Reddish-brown, noncalcareous, blocky clay; limestone bedrock at depths between 20 and 40 inches.
BcB	Byrds clay, 1 to 3 percent slopes	Same	Same
ByB	Byrds clay, shallow, 0 to 3 percent slopes	Same	Same, except that limestone bedrock is at depths between 10 and 20 inches.
Cc	Cottonwood clay loam	Brown, strongly calcareous, crumbly clay loam, 2 to 10 inches thick.	None
DrB	Drake clay loam, 1 to 3 percent slopes	Grayish-brown very strongly calcareous, crumbly clay loam, 4 to 8 inches thick.	Light brownish-gray, strongly calcareous, crumbly clay loam.
EnB	Enterprise fine sandy loam, 1 to 3 percent slopes.	Brown, noncalcareous, friable fine sandy loam, 12 to 20 inches thick.	Reddish-brown, noncalcareous, friable fine sandy loam
EnC2	Enterprise fine sandy loam, 1 to 5 percent slopes, eroded.	Brown, noncalcareous, friable fine sandy loam, 12 to 20 inches thick.	Reddish-brown, noncalcareous, friable fine sandy loam
EpD	Enterprise-Miles complex, 5 to 12 percent slopes.	See descriptions of Enterprise and Miles soils	See descriptions of Enterprise and Miles soils
FcA	Foard clay loam, 0 to 1 percent slopes	Dark-brown noncalcareous, crumbly clay loam, 4 to 10 inches thick.	Dark-brown, noncalcareous, blocky, heavy clay
FcB	Foard clay loam, 1 to 3 percent slopes	Same	Dark-brown, noncalcareous, blocky, heavy clay
FcB2	Foard clay loam, 1 to 3 percent slopes, eroded.	Same	Dark-brown, noncalcareous, blocky, heavy clay
HoA	Hollister clay loam, 0 to 1 percent slopes	Dark-brown, noncalcareous, crumbly clay loam, 4 to 8 inches thick.	Dark-brown, noncalcareous, crumbly clay in uppermost 4 to 6 inches and blocky, heavy clay below.
HoB	Hollister clay loam, 1 to 3 percent slopes	Same	Same
MaB	Mansker clay loam, 0 to 3 percent slopes	Brown, strongly calcareous, friable clay loam, 6 to 10 inches thick.	Brown, strongly calcareous, crumbly, heavy clay loam; caliche horizon at depths of 10 to 24 inches.
MaC2	Mansker clay loam, 1 to 5 percent slopes, eroded.	Same	Same
Mk	Miles loamy fine sand, undulating	Brown, noncalcareous, very friable loamy fine sand, 10 to 18 inches thick.	Yellowish-red, noncalcareous sandy clay loam that has weak, coarse structure.
Mh2	Miles loamy fine sand, hummocky, eroded	Same	Same
MfA	Miles fine sandy loam, 0 to 1 percent slopes	Reddish-brown, noncalcareous, friable fine sandy loam, 6 to 10 inches thick.	Reddish-brown, crumbly sandy clay loam in the upper part and red sandy clay loam in the lower part; moderate, medium, prismatic and subangular blocky structure in the lower subsoil; noncalcareous.
MfB	Miles fine sandy loam, 1 to 3 percent slopes	Same	Same
MfB2	Miles fine sandy loam, 1 to 3 percent slopes eroded.	Same	Same
MfC2	Miles fine sandy loam, 3 to 5 percent slopes, eroded.	Same as Miles fine sandy loam, 0 to 1 percent slopes, except that the surface soil is only 3 to 6 inches thick.	Reddish-brown, crumbly, sandy clay loam in the upper part and red sandy clay loam in the lower part; moderate, medium, prismatic and subangular blocky structure in the lower subsoil; noncalcareous.
MfD2	Miles fine sandy loam, 5 to 8 percent slopes, eroded.	Same	Same
Md	Miles fine sandy loam, undulating	Same as Miles fine sandy loam, 0 to 1 percent slopes	Same
Md2	Miles fine sandy loam, undulating, eroded	Same as Miles fine sandy loam, 0 to 1 percent slopes	Same
Ms	Miller silty clay loam	Reddish-brown, calcareous, crumbly, silty clay loam, 6 to 12 inches thick.	Dark reddish-brown; calcareous; moderate, medium and coarse, irregular blocky clay.
Mr	Miller clay	Reddish-brown, calcareous, weak, subangular blocky, sticky clay.	Reddish-brown, calcareous, massive, sticky clay
No	Norwood silty clay loam	Reddish-brown, calcareous, friable silty clay loam, 8 to 20 inches thick.	Yellowish-red, calcareous, moderate, medium, subangular blocky silty clay loam that is more sandy at depths below 26 to 40 inches.
OcB	Owens clay, 1 to 3 percent slopes	Dark grayish-brown, calcareous, crumbly, but sticky, clay, 5 to 14 inches thick.	Grayish-brown, calcareous, moderate, coarse, blocky, sticky clay.
PfA	Portales fine sandy loam, 0 to 1 percent slopes.	Grayish-brown, calcareous, friable fine sandy loam, 5 to 10 inches thick.	Dark grayish-brown, strongly calcareous clay loam; moderate to strong, medium and fine, subangular blocky structure; a horizon of caliche is at a depth between 20 and 36 inches.
PcA	Portales clay loam, 0 to 1 percent slopes	Brown, calcareous, friable, light clay loam, 5 to 10 inches thick.	Dark grayish-brown, calcareous, light clay loam; moderate, coarse, prismatic and moderate to strong, medium and fine, subangular blocky structure; a horizon of caliche is at a depth between 20 and 36 inches.
Ra	Randall clay	Very dark gray, noncalcareous, sticky clay, 4 to 8 inches thick.	Dark-gray; noncalcareous; weak, coarse, blocky, sticky clay.
RcA	Roscoe clay, 0 to 1 percent slopes	Dark grayish-brown, calcareous, sticky clay, 14 to 24 inches thick.	Very dark gray, calcareous clay; moderate, medium and fine, subangular blocky structure in upper part and dark grayish-brown clay in lower part with moderate, medium and coarse, blocky structure.
RcB	Roscoe clay, 1 to 3 percent slopes	Same	Same
Rs	Rough broken land, sandy	Reddish, strongly calcareous sandy material	Reddish, strongly calcareous, sandy material
Ro	Rough broken land, clayey	Reddish, strongly calcareous clayey material	Reddish, strongly calcareous shaly clay
Sa	Sandy alluvial fans	Reddish, strongly calcareous, sandy alluvial material, 3 to 6 feet thick.	----------
Sk	Springer loamy fine sand, undulating	Brown, noncalcareous, structureless loamy fine sand, 10 to 20 inches thick.	Reddish-brown, massive but crumbly, noncalcareous, heavy fine sandy loam in uppermost 5 to 12 inches and yellowish-red fine sandy loam in lower part.
Sh	Springer loamy fine sand, hummocky	Same	Same
Sm	Springer-Altus loamy fine sands	Same as that of Springer and Altus loamy fine sands	Same as that of Springer and Altus loamy fine sands
Sr	Spur soils	Brownish, noncalcareous, friable fine sandy loam to loam, 9 to 18 inches thick.	Sandy clay loam to clay loam that is stratified in many places.

Parent material	Topography	Erosion hazard		Drainage		Plant-soil-moisture relationship	Capability unit
		Wind	Water	Surface	Internal		
Yellowish-red, calcareous, clayey outwash.	Nearly level	Slight	None	Slow	Slow	Fair	IIc-1.
Same	Gently sloping	Slight	Moderate	Slow to medium.	Slow	Fair	IIe-2.
Same	Gently sloping	Slight	Moderate	Same	Slow	Fair	IIIe-2.
Same	Nearly level	Slight	None	Slow	Slow	Fair	IIc-1.
Same	Gently sloping	Slight	Slight	Slow to medium.	Slow	Fair	IIe-2.
Same as that of soils in Abilene and Miles series.	Undulating	Moderate	Slight	Very slow	Medium	Good	IIe-1.
Recent alluvium	Nearly level	Severe	Deposition by water.	Slow	Rapid	Very good	VIe-4.
Light-gray fine sandy loam	Nearly level	Moderate	None	Very slow.	Slow	Good	IIIe-6.
Limestone	Nearly level	None	None	Slow	Slow	Fair	IIs-1.
Limestone	Gently sloping	None	Slight to moderate.	Slow to medium.	Slow	Fair	IIe-4.
Limestone	Nearly level to gently sloping	None	Moderate	Slow to medium.	Slow	Fair	IIIe-3.
Soft gypsum	Gently sloping	Moderate	Moderate	Slow to medium.	Slow	Fair	VIe-3.
Light-gray eolian material	Gently sloping low dunes	Moderate	Moderate	Slow to medium.	Medium	Fair	IIIe-7.
Eolian sand	Gently sloping	Moderate	Slight	Slow	Medium to rapid.	Very good	IIIe-5.
Eolian sand	Gently to moderately sloping	Moderate	Moderate	Medium	Medium to rapid.	Very good	IVe-3.
Old alluvium	Sloping	Moderate	Severe	Rapid	Medium	Good	VIe-1.
Material from red beds	Nearly level	None	Slight	Very slow.	Very slow.	Poor	IIs-2.
Material from red beds	Gently sloping	None	Moderate	Slow to medium.	Very slow.	Poor	IIIe-1.
Material from red beds	Gently sloping	None	Moderate	Slow to medium.	Very slow.	Poor	IIIe-1.
Material from red beds	Nearly level	None	Slight	Slow	Slow	Fair	IIc-1.
Material from red beds	Gently sloping	None	Moderate	Slow to medium.	Slow	Fair	IIe-2.
Light-brown clay loam outwash	Level to gently sloping	Slight	Slight to moderate.	Slow to medium.	Medium	Good	IIIe-7.
Light-brown clay loam outwash	Gently sloping	Slight	Moderate	Medium	Medium	Good	IVe-2.
Sandy clay loam	Undulating	Severe	None	Slow	Medium	Very good	IIIe-6.
Sandy clay loam	Hummocky	Severe	Slight	Medium	Medium	Very good	IVe-5.
Sandy clay loam, outwash	Nearly level	Moderate	None	Slow	Medium	Very good	IIe-1.
Sandy clay loam, outwash	Gently sloping	Moderate	Moderate	Medium	Medium	Very good	IIe-1.
Sandy clay loam, outwash	Gently sloping	Moderate	Moderate	Medium	Medium	Very good	IIIe-4.
Sandy clay loam, outwash	Sloping	Moderate	Moderate	Medium	Medium	Very good-	IVe-3.
Sandy clay loam, outwash	Sloping	Moderate	Moderate	Rapid	Medium	Very good	VIe-1.
Sandy clay loam, outwash	Undulating	Moderate	Slight	Slow	Medium	Very good	IIe-1.
Sandy clay loam, outwash	Undulating	Moderate	Slight	Slow	Medium	Very good	IIIe-4.
Recent alluvium	Level	None	Occasional overflow.	Slow	Slow	Fair	IIc-2.
Recent alluvium	Level	None	Occasional overflow.	Very slow.	Slow	Poor	IIs-3.
Recent alluvium	Nearly level	Slight	Occasional overflow.	Slow	Medium	Good	IIc-2.
Gray shaly clay	Gently sloping	None	Moderate	Slow to medium.	Very slow.	Poor	IIIe-8.
Calcareous loamy material	Nearly level	Moderate	None	Slow to medium.	Slow to medium.	Good	IIe-1.
Calcareous loamy material	Level	None	None	Slow	Slow	Fair	IIc-1.
Gray clay	Concave	None	None	Lacking	Very slow.	Poor	IIIw-1.
Reddish-yellow clay from outwash	Nearly level	None	None	Slow	Slow	Fair	IIs-1.
Reddish-yellow clay from outwash	Gently sloping	None	Moderate	Slow to medium.	Slow	Fair	IIe-4.
Reddish loamy material	Steep	Moderate	Severe	Rapid	Medium	Good	VIIe-1.
Clayey red beds	Steep	None	Severe	Rapid	Very slow.	Poor	VIIe-1.
Colluvial alluvium	Sloping	Severe	Severe	Medium to rapid.	Rapid	Very good	IVe-4.
Reddish fine sandy loam from outwash that has been reworked by wind.	Undulating or complex slopes	Severe	Slight	Medium	Rapid	Very good	IVe-5.
Same	Hummocky	Severe	Slight	Medium	Rapid	Very good	VIe-2.
Same as that of Springer and Altus soils	Undulating	Moderate	None	Slow	Medium to rapid.	Very good	IIIe-6.
Recent alluvium	Nearly level	Slight	Some overflow	Slow	Slow	Good	IVw-1.

Map symbol	Soil name	Soil profile	
		Surface soil	Subsoil
StB	Stamford clay, 1 to 3 percent slopes---------	Reddish-brown, calcareous, coarse, blocky, sticky clay.	Reddish-brown, calcareous, very coarse, blocky, sticky clay.
StC	Stamford clay, 3 to 5 percent slopes---------	Same--	Same--
StC2	Stamford clay, 3 to 5 percent slopes, eroded-	Same--	Same--
TaD	Tarrant stony clay, 0 to 8 percent slopes----	Very dark gray, calcareous, very crumbly, stony clay, 0 to 8 inches thick; rests on limestone bedrock.	--
TaF	Tarrant stony clay, 8 to 20 percent slopes---	Same, except that the surface soil is only 0 to 4 inches thick.	--
TcA	Tillman clay loam, 0 to 1 percent slopes-----	Reddish-brown, noncalcareous, sticky clay loam, 4 to 7 inches thick.	Reddish-brown, sticky clay; weakly calcareous; moderate, medium, angular blocky structure.
TcB	Tillman clay loam, 1 to 3 percent slopes-----	Same--	Same--
TcB2	Tillman clay loam, 1 to 3 percent slopes, eroded.	Same--	Same--
TcC	Tillman clay loam, 3 to 5 percent slopes-----	Same, except that the surface soil is only 2 to 5 inches thick.	Same--
TmB	Tillman clay loam, shallow, 0 to 3 percent slopes.	Reddish-brown, sticky clay loam, 4 to 7 inches thick; generally noncalcareous but weakly calcareous in places.	Reddish-brown, weakly calcareous, strong to moderate, medium, blocky, sticky clay; C_{ca} horizon is at depths between 10 and 24 inches.
TmC	Tillman clay loam, shallow, 3 to 5 percent slopes.	Same--	Same--
TmC2	Tillman clay loam, shallow, 1 to 5 percent slopes, eroded.	Same--	Same--
TrA	Tillman-Foard complex, 0 to 1 percent slopes.	Same as that of Tillman and Foard soils------------------	Same as that of Tillman and Foard soils--------------------
TtA	Tipton loam, 0 to 1 percent slopes-----------	Brown to dark-brown, noncalcareous, friable loam, 10 to 20 inches thick.	Reddish-brown, noncalcareous, weak, fine, subangular blocky, crumbly sandy clay loam.
VaA	Valera clay, 0 to 1 percent slopes-----------	Dark-brown, calcareous, very sticky, but very crumbly, clay.	Dark-brown, calcareous, moderate medium, subangular blocky clay; limestone bedrock at depths between 20 and 44 inches.
VaB	Valera clay, 1 to 3 percent slopes-----------	Same--	Same--
VcB	Valera clay, shallow, 0 to 3 percent slopes--	Dark-brown, calcareous, very crumbly clay----------------	Brown, strongly calcareous, moderate, fine, subangular blocky clay; limestone at depths between 10 and 20 inches.
VeB	Valera stony clay, 0 to 3 percent slopes-----	Dark-brown, calcareous, very sticky, very crumbly stony clay.	Depth to limestone ranges from 10 to 30 inches-------------
VnD	Vernon clay, 3 to 8 percent slopes-----------	Reddish-brown, calcareous, sticky clay, 5 to 15 inches thick.	None--
Vr	Vernon complex------------------------------	Red, calcareous, sticky clay, 0 to 5 inches thick---------	None--
WcA	Wichita clay loam, 0 to 1 percent slopes-----	Reddish-brown, noncalcareous, friable clay loam, 6 to 8 inches thick.	Dark reddish-brown, noncalcareous, moderate, medium, blocky clay.
WcB	Wichita clay loam, 1 to 3 percent slopes-----	Same--	Dark reddish-brown, noncalcareous clay; depth to the C_{ca} horizon is about 42 inches.
WcB2	Wichita clay loam, 1 to 3 percent slopes, eroded.	Reddish-brown, noncalcareous, friable clay loam, 6 to 8 inches thick.	Dark reddish-brown, noncalcareous clay; depth to the C_{ca} horizon is about 42 inches.
WgB	Wichita gravelly loam, 1 to 5 percent slopes-	Brownish, loamy, gravelly material------------------------	Material from beds of gravel------------------------------
Ya	Yahola fine sandy loam-----------------------	Yellowish-red, calcareous fine sandy loam, 16 to 40 inches thick.	Yellowish-red, calcareous, light fine sandy loam, stratified.

Parent material	Topography	Erosion hazard		Drainage		Plant-soil-moisture relationship	Capability unit
		Wind	Water	Surface	Internal		
Clay from red beds	Gently sloping	None	Moderate	Slow	Very slow.	Poor	IIIe-8.
Clay from red beds	Sloping	None	Moderate to severe.	Rapid	Very slow.	Poor	IVe-1.
Clay from red beds	Sloping	None	Moderate to severe.	Rapid	Very slow.	Poor	IVe-1.
Limestone	Sloping	None	Slight to moderate.	Medium to rapid.	Slow	Fair	VIs-1.
Limestone	Strongly sloping	Geologic	-------------	Rapid	Slow	Fair	VIIs-1.
Clay from red beds	Nearly level	None	Slight	Slow	Very slow.	Poor	IIs-2.
Clay from red beds	Gently sloping	None	Moderate	Medium	Very slow.	Poor	IIIe-1.
Clay from red beds	Gently sloping	None	Moderate	Medium	Very slow.	Poor	IIIe-1.
Clay from red beds	Sloping	None	Moderate to severe.	Rapid	Very slow.	Poor	IVe-1.
Clay from red beds	Gently sloping	None	Slight to moderate.	Slow to medium.	Slow	Poor	IIIe-3.
Clay from red beds	Sloping	None	Moderate	Rapid	Slow	Poor	IVe-2.
Clay from red beds	Gently sloping to sloping	None	Moderate	Rapid	Slow	Poor	IVe-2.
Clays from red beds	Nearly level	None	None	Very slow.	Very slow.	Poor	IIs-2.
Old stream alluvium	Nearly level	Slight	None	Slow	Medium	Very good	I-1.
Limestone	Nearly level	None	None	Slow	Slow	Fair	IIs-1.
Limestone	Gently sloping	None	Slight	Slow to medium.	Slow	Fair	IIe-4.
Limestone	Gently sloping	None	Slight	Slow to medium.	Medium	Good	IIIe-3.
Limestone	Gently sloping	None	Slight	Slow to medium.	Medium	Good	VIs-1.
Clay from red beds	Sloping	None	Severe	Slow to rapid.	Very slow.	Poor	VIe-3.
Clay from red beds	Strongly sloping	None	Severe	Rapid	Very slow.	Poor	VIIe-1.
Old stream alluvium	Nearly level	Slight	None	Slow	Slow	Fair	IIc-1.
Old stream alluvium	Gently sloping	Slight	Slight to moderate.	Slow to medium.	Slow	Fair	IIe-2.
Old stream alluvium	Gently sloping	Slight	Slight to moderate.	Slow to medium.	Slow	Fair	IIIe-2.
Gravelly loam	Gently sloping	None	Slight	Medium	Rapid	Good	VIe-1.
Recent alluvium	Nearly level	Moderate	Occasional overflow.	Slow	Rapid	Very good	IIe-3.

GUIDE TO MAPPING UNITS[1]

[In range site column, the resource area is indicated by letters as follows: RP = Rolling Plains; RP-L = Rolling Plains-Limestone]

Map symbol	Mapping unit	Page	Capability unit	Page	Range site
AcA	Abilene clay loam, 0 to 1 percent slopes	6	IIc-1	33	Deep Hardlands, RP.
AcB	Abilene clay loam, 1 to 3 percent slopes	6	IIe-2	33	Deep Hardlands, RP.
AcB2	Abilene clay loam, 1 to 3 percent slopes, eroded	6	IIIe-2	35	Deep Hardlands, RP.
AdA	Abilene loam, 0 to 1 percent slopes	7	IIc-1	33	Deep Hardlands, RP.
AdB	Abilene loam, 1 to 3 percent slopes	7	IIe-2	33	Deep Hardlands, RP.
Ae	Abilene-Miles complex	7	IIe-1	33	Mixed Land, RP.
Al	Alluvial land	7	VIe-4	38	Bottom Land, RP.
At	Altus loamy fine sand	8	IIIe-6	36	Sandy Land, RP.
BcA	Byrds clay, 0 to 1 percent slopes	8	IIs-1	34	Deep Hardlands, RP-L.
BcB	Byrds clay, 1 to 3 percent slopes	9	IIe-4	34	Deep Hardlands, RP-L.
ByB	Byrds clay, shallow, 0 to 3 percent slopes	9	IIIe-3	35	Shallow Land, RP-L.
Cc	Cottonwood clay loam	9	VIe-3	38	Shallow Hardlands, RP.
DrB	Drake clay loam, 1 to 3 percent slopes	10	IIIe-7	36	Mixed Land, RP.
EnB	Enterprise fine sandy loam, 1 to 3 percent slopes	10	IIIe-5	36	Mixed Land, RP.
EnC2	Enterprise fine sandy loam, 1 to 5 percent slopes, eroded	10	IVe-3	37	Mixed Land, RP.
EpD	Enterprise-Miles complex, 5 to 12 percent slopes	10	VIe-1	38	Mixed Land, RP.
FcA	Foard clay loam, 0 to 1 percent slopes	12	IIs-2	34	Deep Hardlands, RP.
FcB	Foard clay loam, 1 to 3 percent slopes	12	IIIe-1	35	Deep Hardlands, RP.
FcB2	Foard clay loam, 1 to 3 percent slopes, eroded	12	IIIe-1	35	Deep Hardlands, RP.
HoA	Hollister clay loam, 0 to 1 percent slopes	13	IIc-1	33	Deep Hardlands, RP.
HoB	Hollsiter clay loam, 1 to 3 percent slopes	13	IIe-2	33	Deep Hardlands, RP.
MaB	Mansker clay loam, 0 to 3 percent slopes	13	IIIe-7	36	Shallow Hardlands, RP.
MaC2	Mansker clay loam, 1 to 5 percent slopes, eroded	13	IVe-2	37	Shallow Hardlands, RP.
MfA	Miles fine sandy loam, 0 to 1 percent slopes	15	IIe-1	33	Mixed Land, RP.
MfB	Miles fine sandy loam, 1 to 3 percent slopes	15	IIe-1	33	Mixed Land, RP.
MfB2	Miles fine sandy loam 1 to 3 percent slopes, eroded	15	IIIe-4	35	Mixed Land, RP.
MfC2	Miles fine sandy loam, 3 to 5 percent slopes, eroded	15	IVe-3	37	Mixed Land, RP.
MfD2	Miles fine sandy loam, 5 to 8 percent slopes, eroded	15	VIe-1	38	Mixed Land, RP.
Md	Miles fine sandy loam, undulating	16	IIe-1	33	Mixed Land, RP.
Md2	Miles fine sandy loam, undulating, eroded	16	IIIe-4	35	Mixed Land, RP.
Mh2	Miles loamy fine sand, hummocky, eroded	14	IVe-5	38	Sandy Land, RP.
Mk	Miles loamy fine sand, undulating	14	IIIe-6	36	Sandy Land, RP.
Mr	Miller clay	17	IIs-3	34	Bottom Land, RP.
Ms	Miller silty clay loam	16	IIw-1	34	Bottom Land, RP.
No	Norwood silty clay loam	17	IIw-1	34	Bottom Land, RP; RP-L.
OcB	Owens clay, 1 to 3 percent slopes	18	IIIe-8	36	Deep Hardlands, RP.
PcA	Portales clay loam, 0 to 1 percent slopes	19	IIc-1	33	Deep Hardlands, RP.
PfA	Portales fine sandy loam, 0 to 1 percent slopes	18	IIe-1	33	Mixed Land, RP.
Ra	Randall clay	19	IIIw-1	37	Deep Hardlands, RP.
RcA	Roscoe clay, 0 to 1 percent slopes	20	IIs-1	34	Deep Hardlands, RP.
RcB	Roscoe clay, 1 to 3 percent slopes	20	IIe-4	34	Deep Hardlands, RP.
Ro	Rough broken land, clayey	20	VIIe-1	39	Rough Breaks, RP.
Rs	Rough broken land, sandy	20	VIIe-1	39	Rough Breaks, RP.
Sa	Sandy alluvial fans	21	IVe-4	37	Bottom Land, RP.
Sh	Springer loamy fine sand, hummocky	21	VIe-2	38	Sandy Land, RP.
Sk	Springer loamy fine sand, undulating	21	IVe-5	38	Sandy Land, RP.
Sm	Springer-Altus loamy fine sands	21	IIIe-6	36	Sandy Land, RP.
Sr	Spur soils	22	IVw-1	38	Bottom Land, RP.
StB	Stamford clay, 1 to 3 percent slopes	22	IIIe-8	36	Deep Hardlands, RP.
StC	Stamford clay, 3 to 5 percent slopes	22	IVe-1	37	Deep Hardlands, RP.
StC2	Stamford clay, 3 to 5 percent slopes, eroded	22	IVe-1	37	Deep Hardlands, RP.
TaD	Tarrant stony clay, 0 to 8 percent slopes	23	VIs-1	39	Shallow Land, RP-L.
TaF	Tarrant stony clay, 8 to 20 percent slopes	23	VIIs-1	39	Rocky Hills, RP-L.
TcA	Tillman clay loam, 0 to 1 percent slopes	24	IIs-2	34	Deep Hardlands, RP.
TcB	Tillman clay loam, 1 to 3 percent slopes	24	IIIe-1	35	Deep Hardlands, RP.
TcB2	Tillman clay loam, 1 to 3 percent slopes, eroded	24	IIIe-1	35	Deep Hardlands, RP.
TcC	Tillman clay loam, 3 to 5 percent slopes	24	IVe-1	37	Deep Hardlands, RP
TmB	Tillman clay loam, shallow, 0 to 3 percent slopes	24	IIIe-3	35	Shallow Hardlands, RP.
TmC	Tillman clay loam, shallow, 3 to 5 percent slopes	24	IVe-2	37	Shallow Hardlands, RP.
TmC2	Tillman clay loam, shallow, 1 to 5 percent slopes, eroded	25	IVe-2	37	Shallow Hardlands, RP.
TrA	Tillman-Foard complex, 0 to 1 percent slopes	25	IIs-2	34	Deep Hardlands, RP.
TtA	Tipton loam, 0 to 1 percent slopes	25	I-1	32	Mixed Land, RP.
VaA	Valera clay, 0 to 1 percent slopes	26	IIs-1	34	Deep Hardlands, RP-L.
VaB	Valera clay, 1 to 3 percent slopes	26	IIe-4	34	Deep Hardlands, RP-L.
VcB	Valera clay, shallow, 0 to 3 percent slopes	26	IIIe-3	35	Shallow Land, RP-L.
VeB	Valera stony clay, 0 to 3 percent slopes	27	VIs-1	39	Shallow Land, RP-L.
VnD	Vernon clay, 3 to 8 percent slopes	27	VIe-3	38	Shallow Hardlands, RP.
Vr	Vernon complex	27	VIIe-1	39	Rough Breaks, RP.
WcA	Wichita clay loam, 0 to 1 percent slopes	28	IIc-1	33	Deep Hardlands, RP.
WcB	Wichita clay loam, 1 to 3 percent slopes	28	IIe-2	33	Deep Hardlands, RP.
WcB2	Wichita clay loam, 1 to 3 percent slopes, eroded	28	IIIe-2	35	Deep Hardlands, RP.
WgB	Wichita gravelly loam, 1 to 5 percent slopes	28	VIe-1	38	Mixed Land, RP.
Ya	Yahola fine sandy loam	29	IIe-3	33	Bottom Land, RP.

[1] Table 1, p. 5, shows the acreage and proportionate extent of the soils, and table 2, p. 39, gives estimated yields of crops. To find information about range management, see section beginning on p. 40. For information about the engineering properties of the soils see the section, Engineering Uses of Soils, beginning on p. 43.

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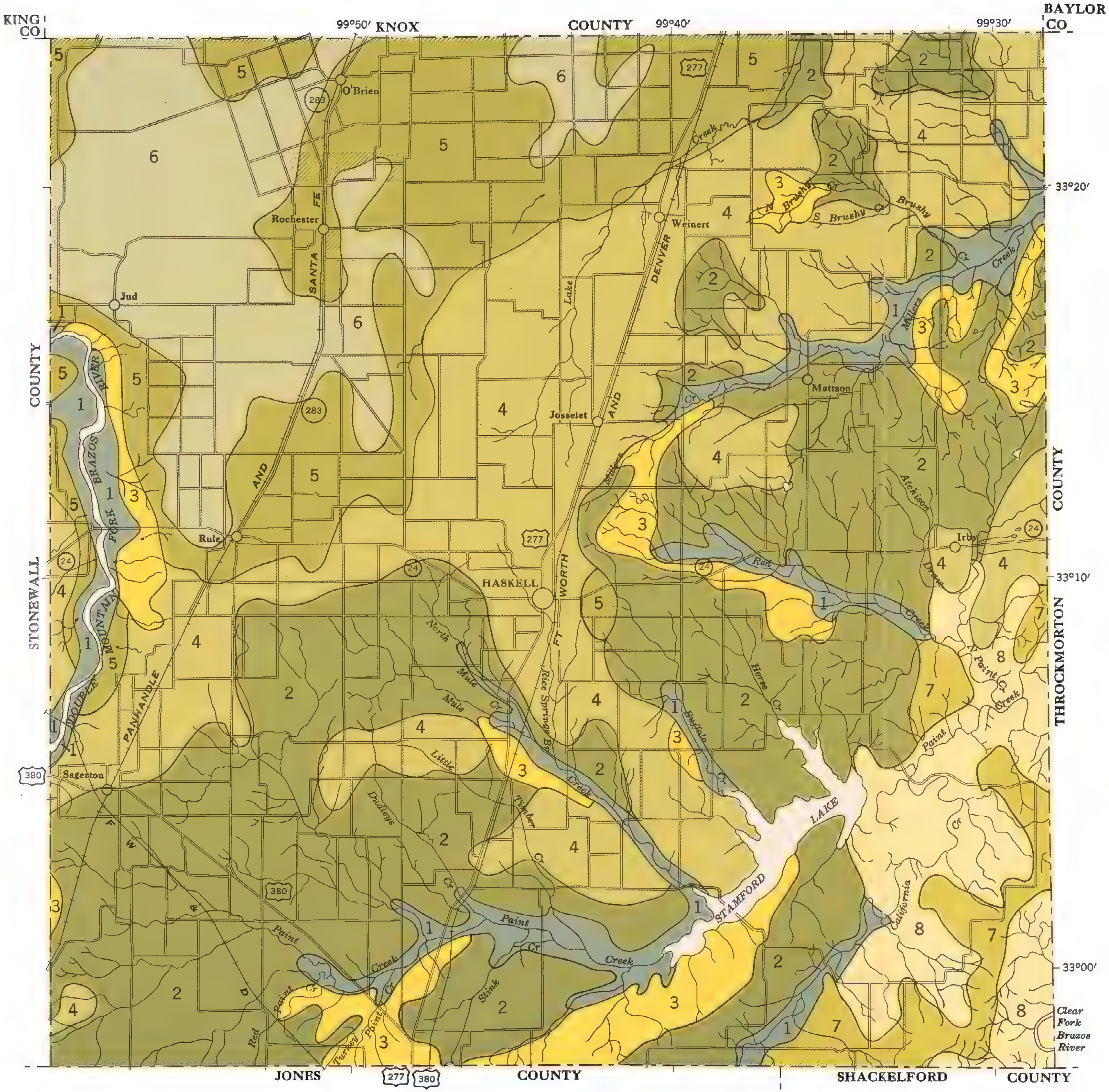


GENERAL SOIL MAP
HASKELL COUNTY, TEXAS

Scale

1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS

SOILS IN ALLUVIUM

1	Fine-textured soils on flood plains: Miller- Norwood

SOILS IN RED-BED MATERIALS

2	Deep clay loams: Tillman-Foard-Hollister
3	Shallow clays and clay loams: Vernon-Tillman, shallow

SOILS IN QUATERNARY OUTWASH

4	Deep clay loams and clays: Abilene-Roscoe
5	Deep loams and fine sandy loams: Abilene-Miles
6	Deep loamy sands: Miles-Springer

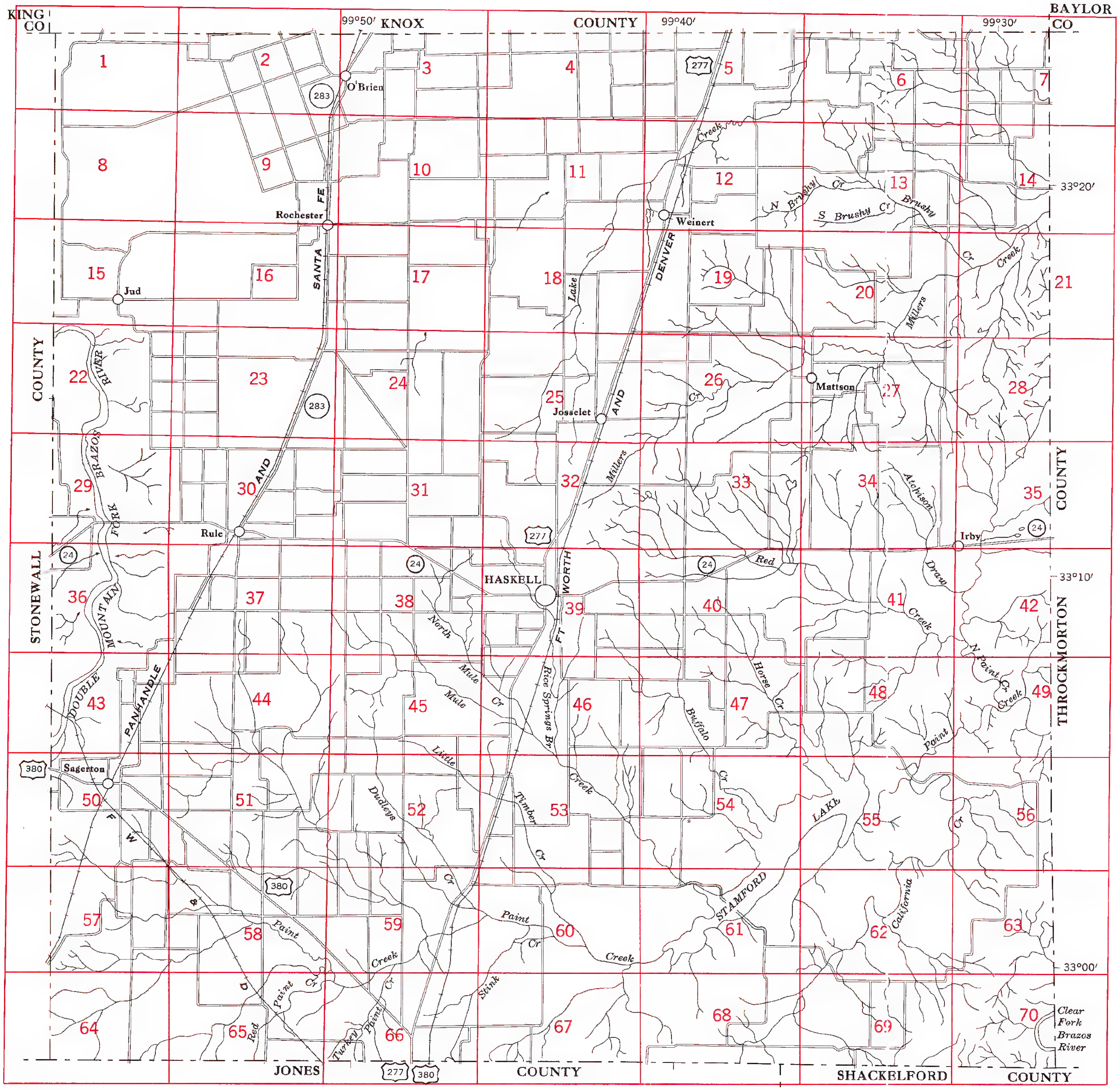
SOILS IN LIMESTONE

7	Moderately deep clays: Valera-Byrds
8	Shallow, stony soils: Tarrant

INDEX TO MAP SHEETS
HASKELL COUNTY, TEXAS

Scale

1 0 1 2 3 4 Miles



CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Roads
- Good motor
- Poor motor
- Trail
- Marker, U. S., State — 33 — 283

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail, foot
- Railroad
- Ferry
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings
- School
- Church
- Station

Mine and Quarry
- Dump

Pits, gravel or other

Power line

Pipeline

Cemetery

Dam

Levee

Tank

Oil well

Windmill

Cotton gin

BOUNDARIES

- National or state
- County
- Township, U. S.
- Section line, corner
- City (corporate)
- Reservation
- Land grant

DRAINAGE

Streams
- Perennial
- Intermittent, unclass.

Canals and ditches — CANAL — DITCH

Lakes and ponds
- Perennial
- Intermittent

Wells — flowing

Springs

Marsh

Wet spot

RELIEF

Escarpments
- Bedrock
- Other

Prominent peaks

Depressions — Large — Small

SOIL SURVEY DATA

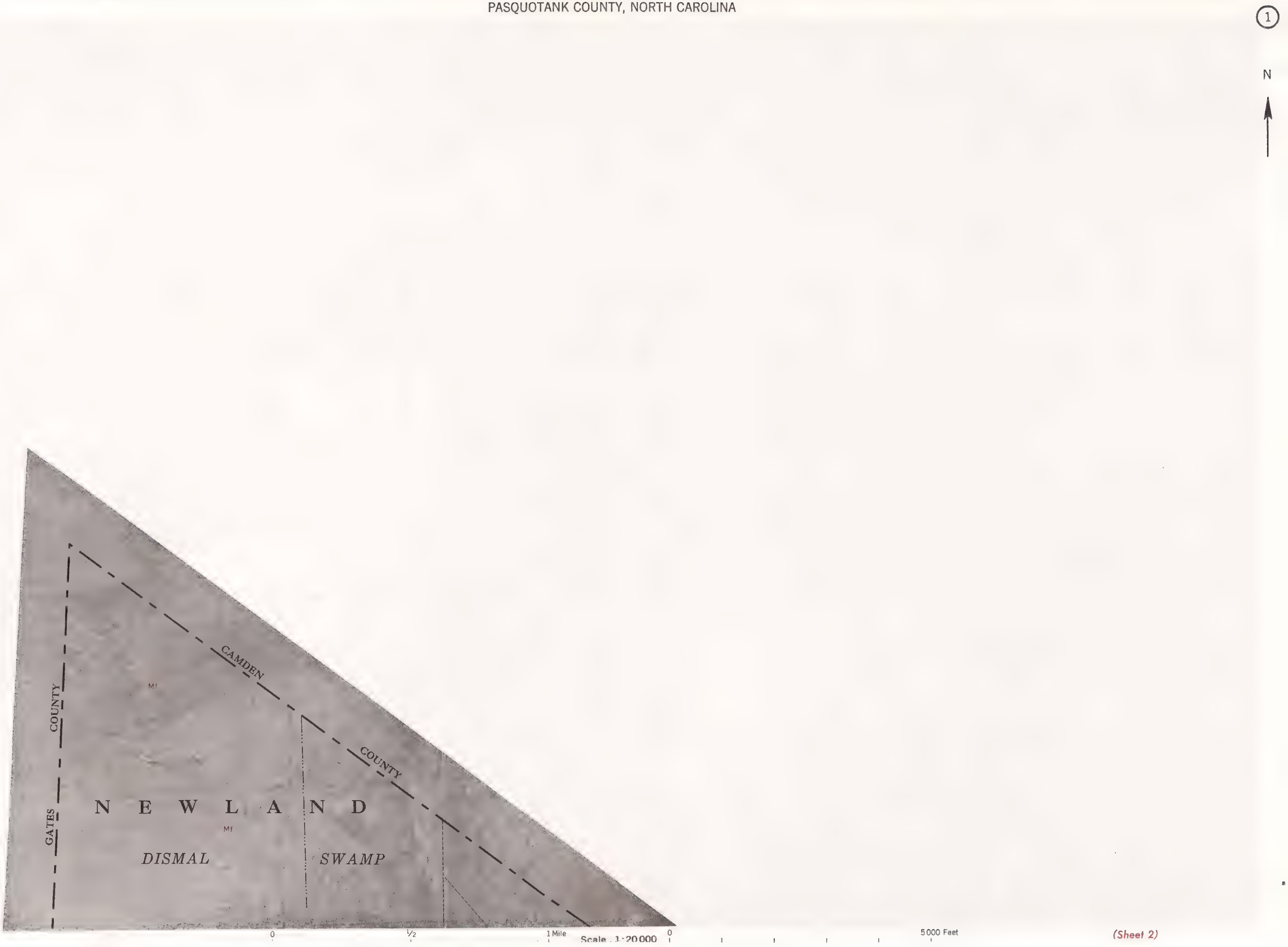
- Soil type outline and symbol — Dx
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Very shallow spot — A
- Slick spot — S

SOIL LEGEND

The first letter in each soil symbol is the initial of the soil series name. If slope forms part of the soil name, a second capital letter shows the range of steepness. Most symbols that do not contain a slope letter shows nearly level or undulating soils. The two map units of Rough broken land have a wide range of slope. A number in the symbol shows an eroded soil.

SYMBOL	NAME
AcA	Abilene clay loam, 0 to 1 percent slopes
AcB	Abilene clay loam, 1 to 3 percent slopes
AcB2	Abilene clay loam, 1 to 3 percent slopes, eroded
Ada	Abilene loam, 0 to 1 percent slopes
AdB	Abilene loam, 1 to 3 percent slopes
Ae	Abilene-Miles complex
Al	Alluvial land
At	Altus loamy fine sand
BcA	Byrds clay, 0 to 1 percent slopes
BcB	Byrds clay, 1 to 3 percent slopes
ByB	Byrds clay, shallow, 0 to 3 percent slopes
Cc	Cottonwood clay loam
DrB	Drake clay loam, 1 to 3 percent slopes
EnB	Enterprise fine sandy loam, 1 to 3 percent slopes
EnC2	Enterprise fine sandy loam, 1 to 5 percent slopes, eroded
EpD	Enterprise-Miles complex, 5 to 12 percent slopes
FcA	Foard clay loam, 0 to 1 percent slopes
FcB	Foard clay loam, 1 to 3 percent slopes
FcB2	Foard clay loam, 1 to 3 percent slopes, eroded
HoA	Hollister clay loam, 0 to 1 percent slopes
HoB	Hollister clay loam, 1 to 3 percent slopes
MaB	Mansker clay loam, 0 to 3 percent slopes
MaC2	Mansker clay loam, 1 to 5 percent slopes, eroded
MfA	Miles fine sandy loam, 0 to 1 percent slopes
MfB	Miles fine sandy loam, 1 to 3 percent slopes
MfB2	Miles fine sandy loam, 1 to 3 percent slopes, eroded
MfC2	Miles fine sandy loam, 3 to 5 percent slopes, eroded
MfD2	Miles fine sandy loam, 5 to 8 percent slopes, eroded
Md	Miles fine sandy loam, undulating
Md2	Miles fine sandy loam, undulating, eroded
Mh2	Miles loamy fine sand, hummocky, eroded
Mk	Miles loamy fine sand, undulating
Mr	Miller clay
Ms	Miller silty clay loam
No	Norwood silty clay loam
OcB	Owens clay, 1 to 3 percent slopes
PcA	Portales clay loam, 0 to 1 percent slopes
PfA	Portales fine sandy loam, 0 to 1 percent slopes
Ra	Randall clay
RcA	Roscoe clay, 0 to 1 percent slopes
RcB	Roscoe clay, 1 to 3 percent slopes
Ro	Rough broken land, clayey
Rs	Rough broken land, sandy
Sa	Sandy alluvial fans
Sh	Springer loamy fine sand, hummocky
Sk	Springer loamy fine sand, undulating
Sm	Springer-Altus loamy fine sands
Sr	Spur soils
StB	Stamford clay, 1 to 3 percent slopes
StC	Stamford clay, 3 to 5 percent slopes
StC2	Stamford clay, 3 to 5 percent slopes, eroded
TaD	Tarrant stony clay, 0 to 8 percent slopes
TaF	Tarrant stony clay, 8 to 20 percent slopes
TcA	Tillman clay loam, 0 to 1 percent slopes
TcB	Tillman clay loam, 1 to 3 percent slopes
TcB2	Tillman clay loam, 1 to 3 percent slopes, eroded
TcC	Tillman clay loam, 3 to 5 percent slopes
TmB	Tillman clay loam, shallow, 0 to 3 percent slopes
TmC	Tillman clay loam, shallow, 3 to 5 percent slopes
TmC2	Tillman clay loam, shallow, 1 to 5 percent slopes, eroded
TrA	Tillman-Foard complex, 0 to 1 percent slopes
TtA	Tipton loam, 0 to 1 percent slopes
VaA	Valera clay, 0 to 1 percent slopes
VaB	Valera clay, 1 to 3 percent slopes
VcB	Valera clay, shallow, 0 to 3 percent slopes
VeB	Valera stony clay, 0 to 3 percent slopes
VnD	Vernon clay, 3 to 8 percent slopes
Vr	Vernon complex
WcA	Wichita clay loam, 0 to 1 percent slopes
WcB	Wichita clay loam, 1 to 3 percent slopes
WcB2	Wichita clay loam, 1 to 3 percent slopes, eroded
WgB	Wichita gravelly loam, 1 to 5 percent slopes
Ya	Yahola fine sandy loam

Soil map constructed 1960 by Cartographic Division, Soil Conservation Service, USDA, from 1956 aerial photographs. Controlled mosaic based on Texas plane coordinate system, north central zone, Lambert conformal conic projection, 1927 North American datum.


1
N
CAMDEN COUNTY
GATES COUNTY
Mf
NEWLAND
Mf
DISMAL SWAMP
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1 Mile
Scale 1:20 000
0
5000 Feet

N

(Sheet 3)

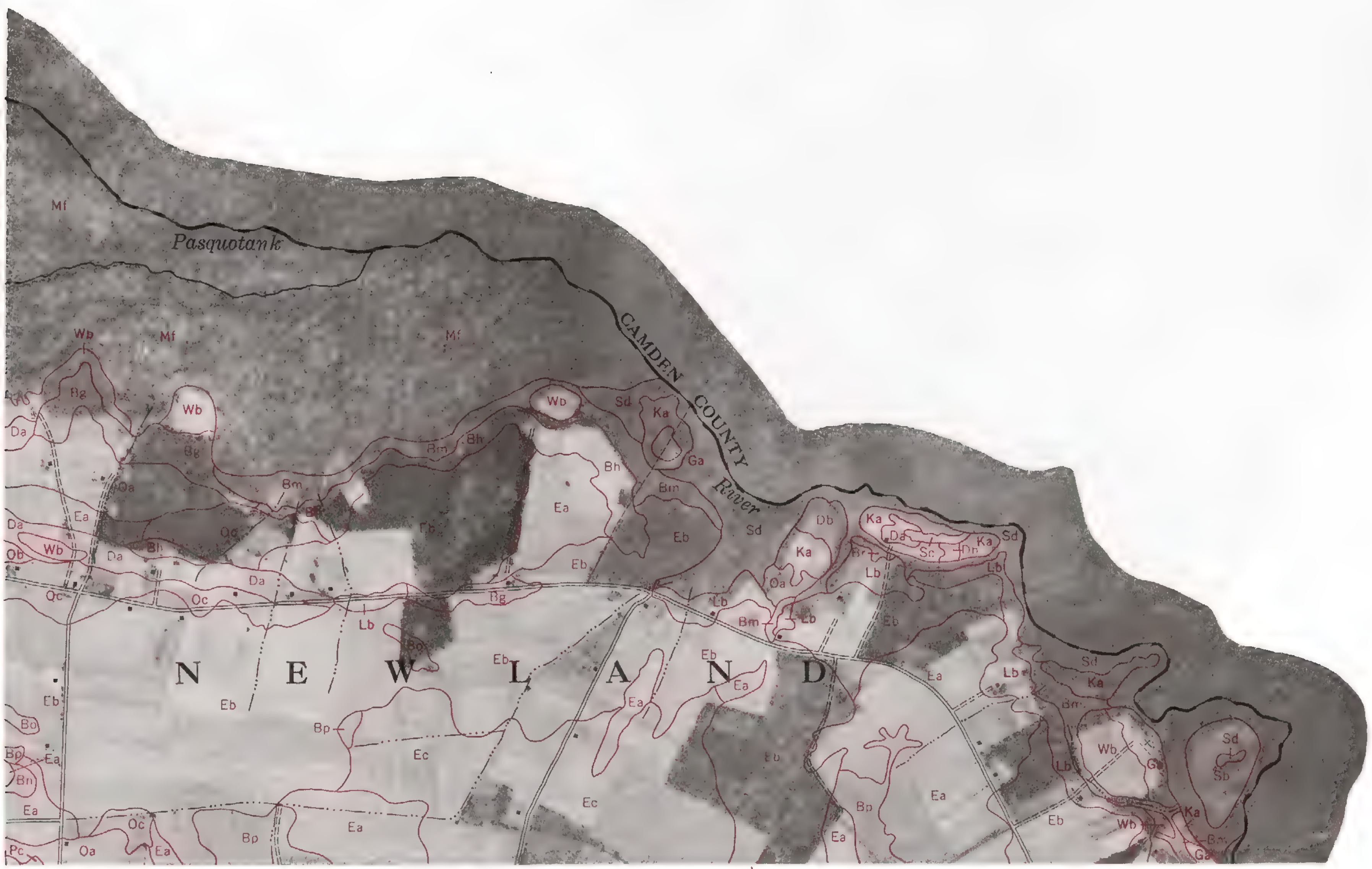
(Sheet 4)

0 ½ 1 Mile 0 5000 Feet

Scale 1:20 000

3

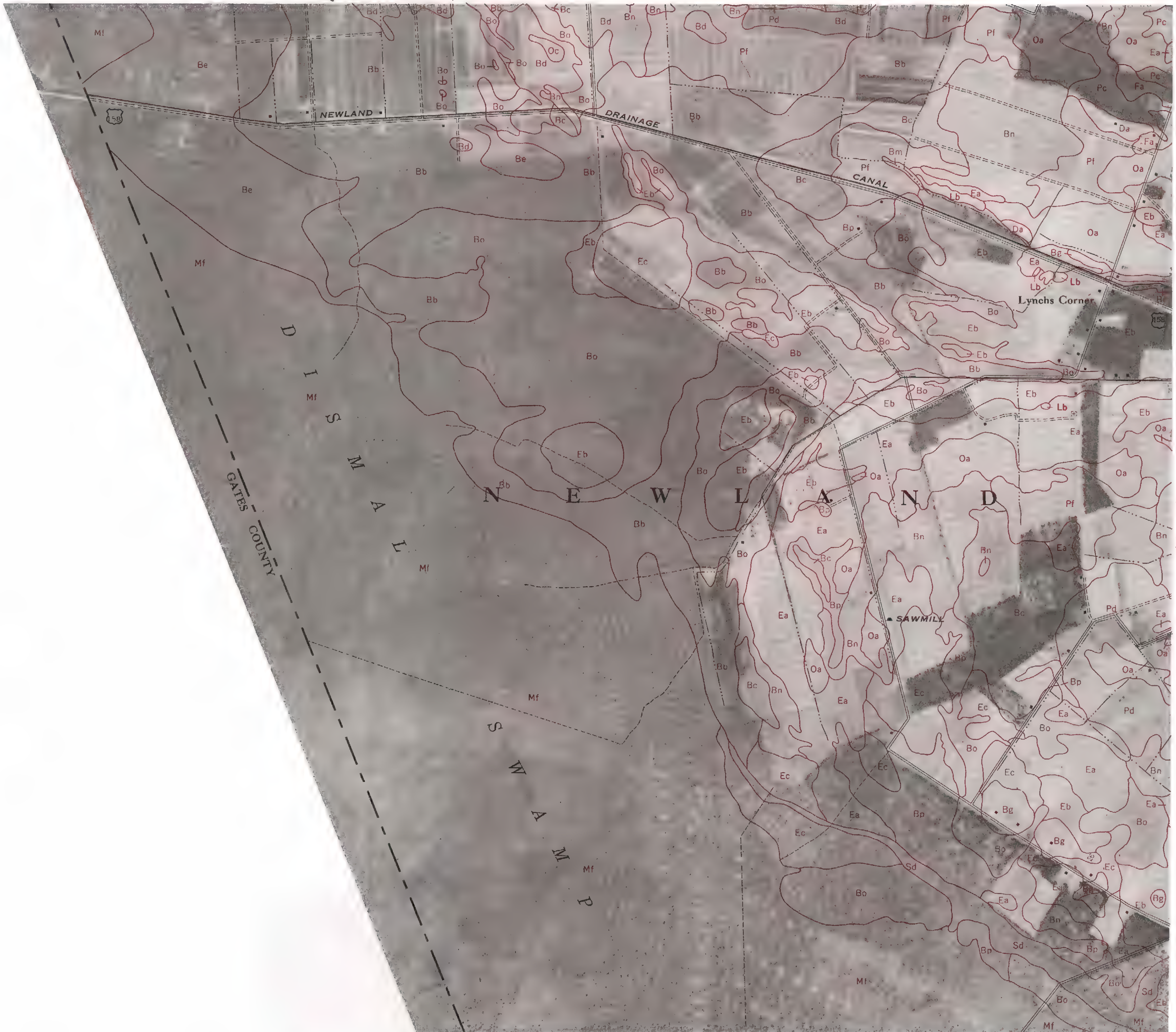
N



0 1/2 1 Mile Scale 1:20000 0 5000 Feet

(Sheet 5)

N



(Sheet 5)

(Sheet 7)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet


N
Newland School
Ramoth Gilead Church
Bethel Church
Newland Church
Jackson Corner
Mt Carmel Church
Mill Pond School
Morgans Corner
CAMDEN COUNTY
Pasquotank
River
NEWLAND
DRAINAGE
CANAL
N E W L A N D
Mill
Pond
Creek
(Sheet 4)
(Sheet 6)
(Sheet 8)
0
½
1 Mile
0
5000 Feet
Scale 1:20 000


6
N
CAMDEN COUNTY
Pasquotank R
PASQUOTANK
NEWLAND
DISMAL SWAMP
PROVIDENCE
LUMBER MILL
Hudson Store
RIVER
CAMDEN COUNTY
(Sheet 5)
(Sheet 9)
Scale 1:20000
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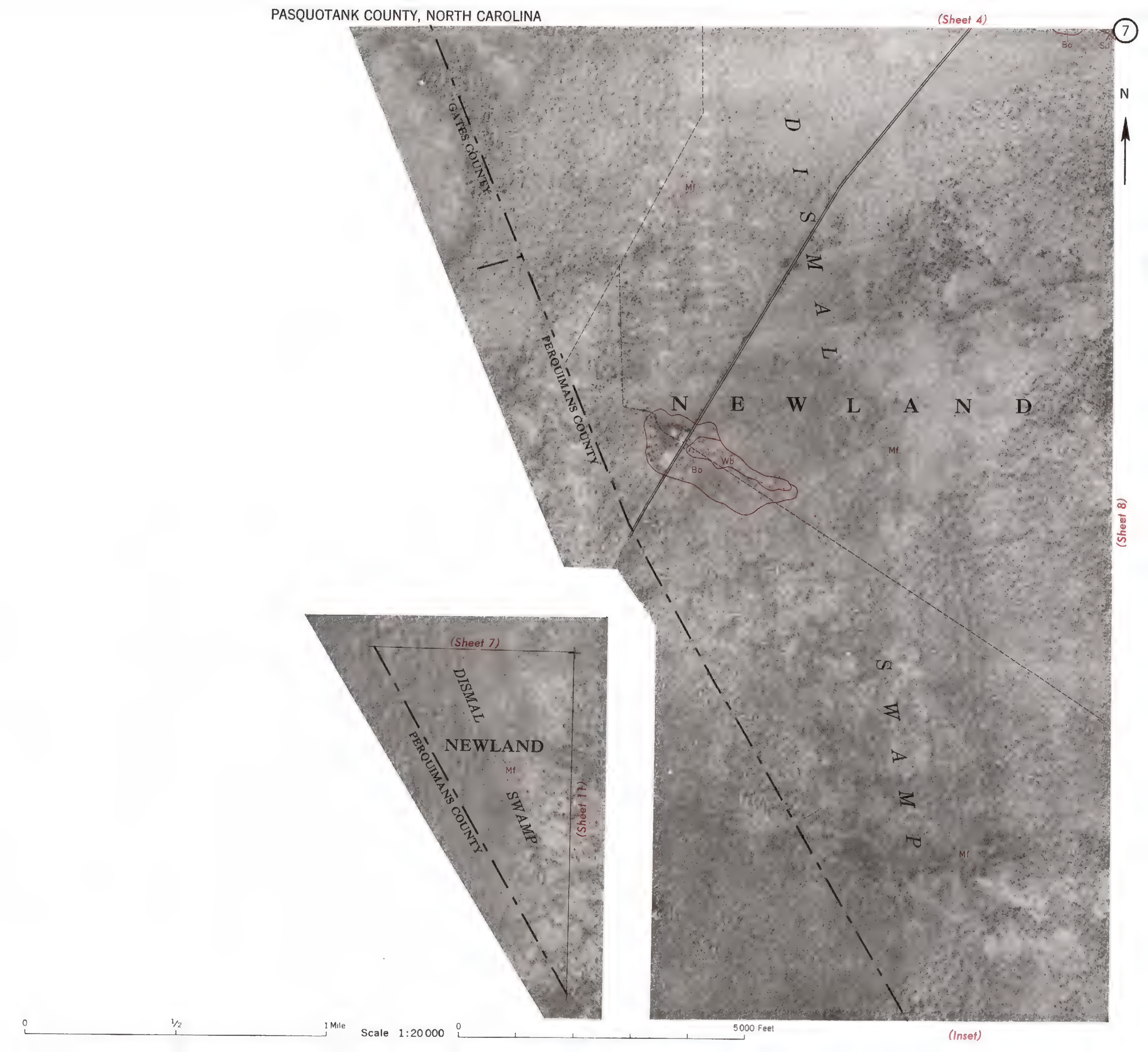
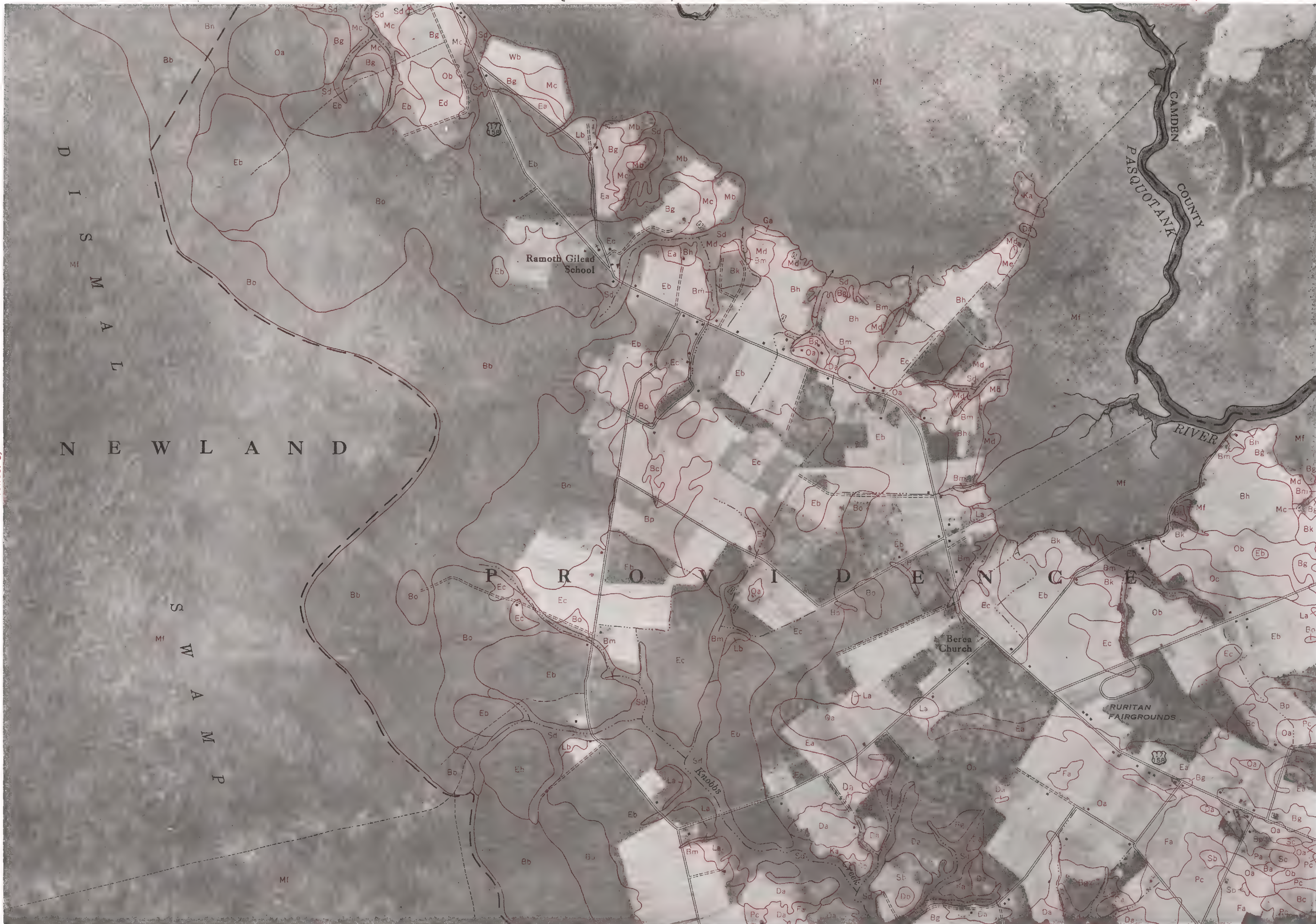
½
1 Mile
0
5000 Feet


(Sheet 4)
7
N
Bo
Su
GATES COUNTY
PERQUIMANS COUNTY
DISMAL
NEWLAND
SWAMP
Mf
Wb
Bo
(Sheet 8)
(Sheet 7)
DISMAL
NEWLAND
Mf
PERQUIMANS COUNTY
SWAMP
(Sheet 11)
(Inset)
0
1/2
1 Mile
Scale 1:20 000
0
5000 Feet

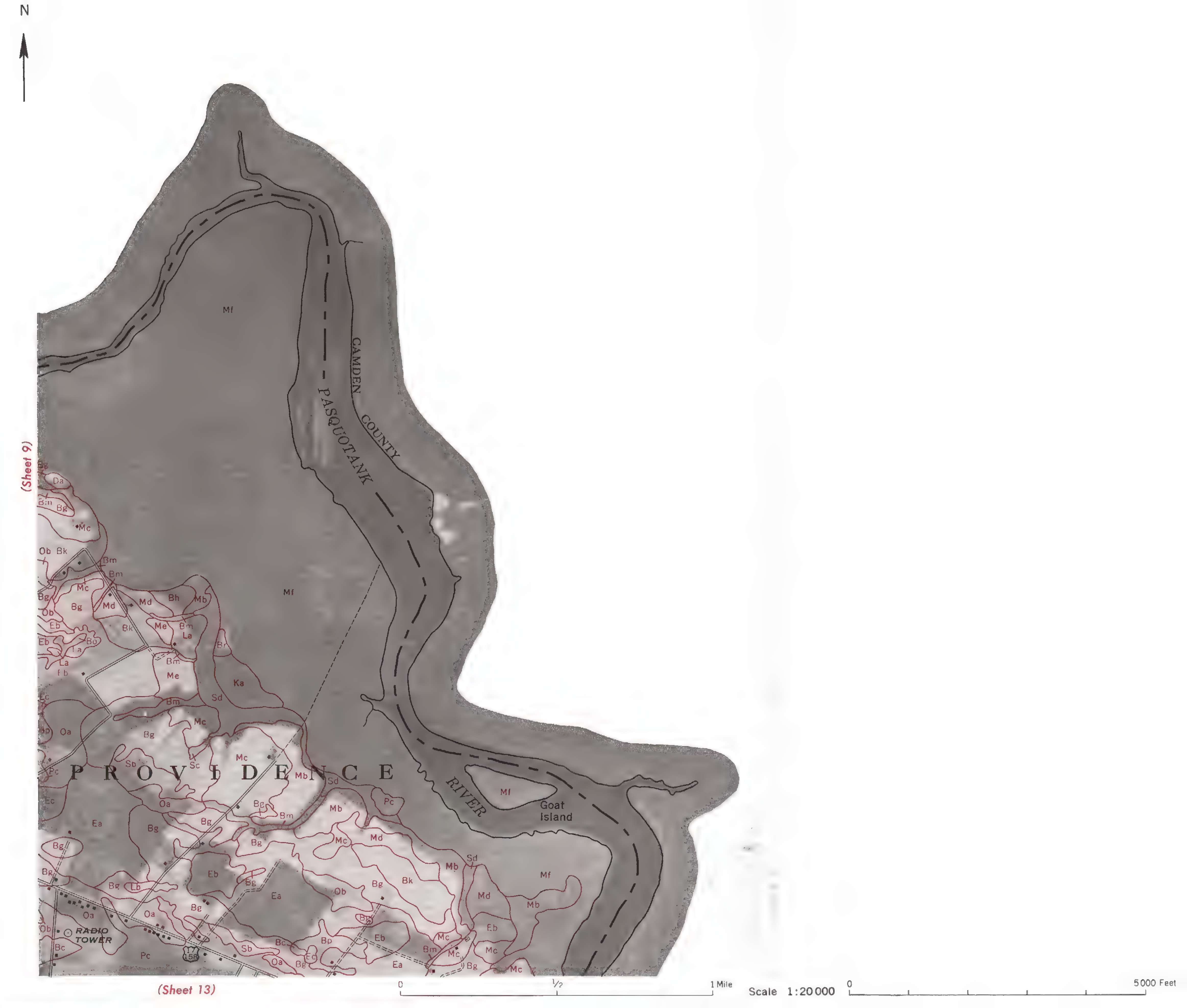

(Sheet 5)
(Sheet 7)
(Sheet 9)
(Sheet 11)
N
N E W L A N D
D I S M A L S W A M P
Mill Pond Cr.
Mf
Bc
Bn
Bb
Pf
Sd
Eb
Lb
Pc
Bp
Fc
Ea
Oa
0 1/2 1 Mile
Scale 1:20 000
0 5000 Feet

(Sheet 8)



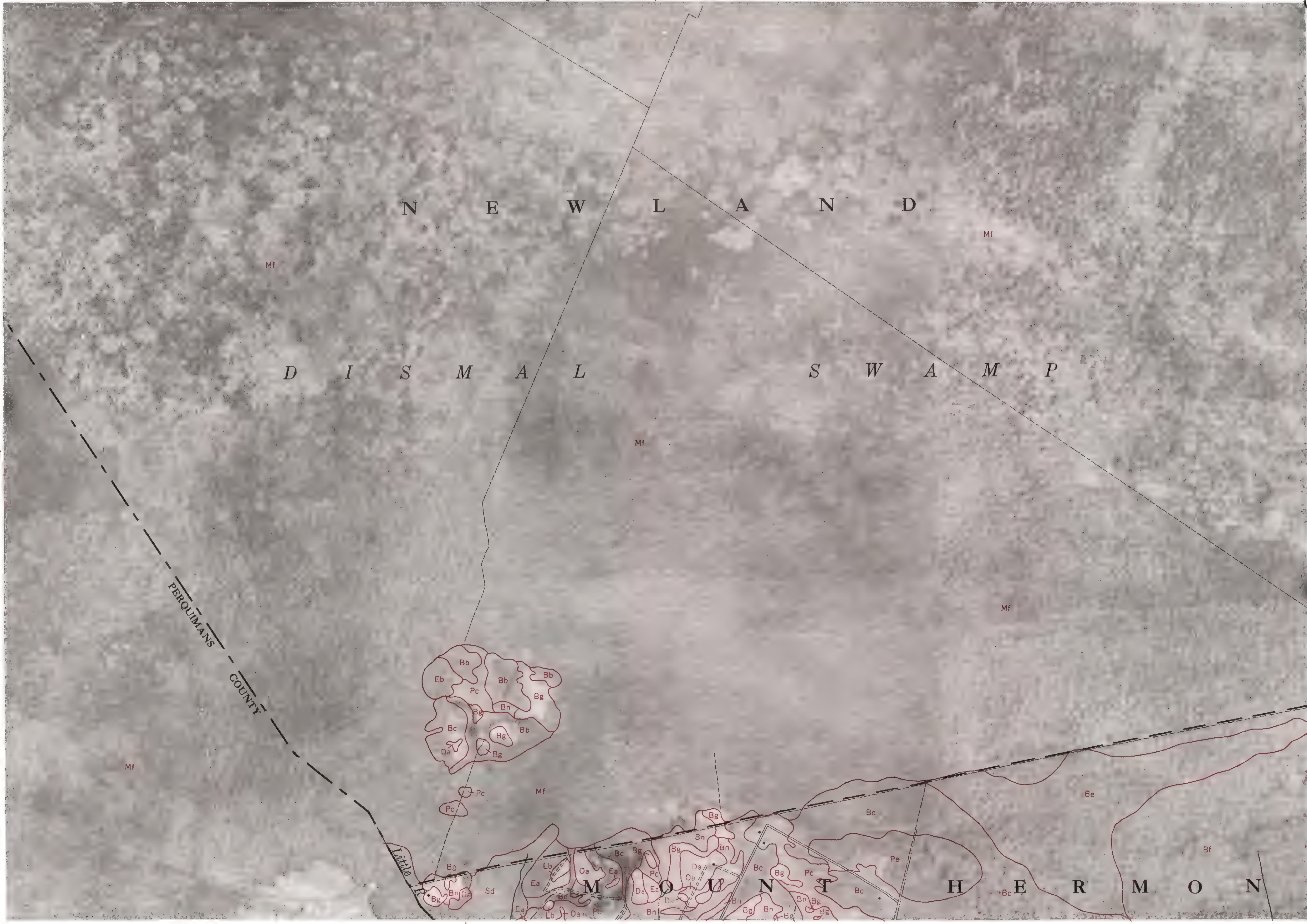
(Sheet 10)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet


N
(Sheet 9)
(Sheet 13)
CAMDEN COUNTY
PASQUOTANK RIVER
PROVIDENCE
Goat Island
RADIO TOWER
0 1/2 1 Mile
Scale 1:20 000
0 5000 Feet

N

(Sheet 7)

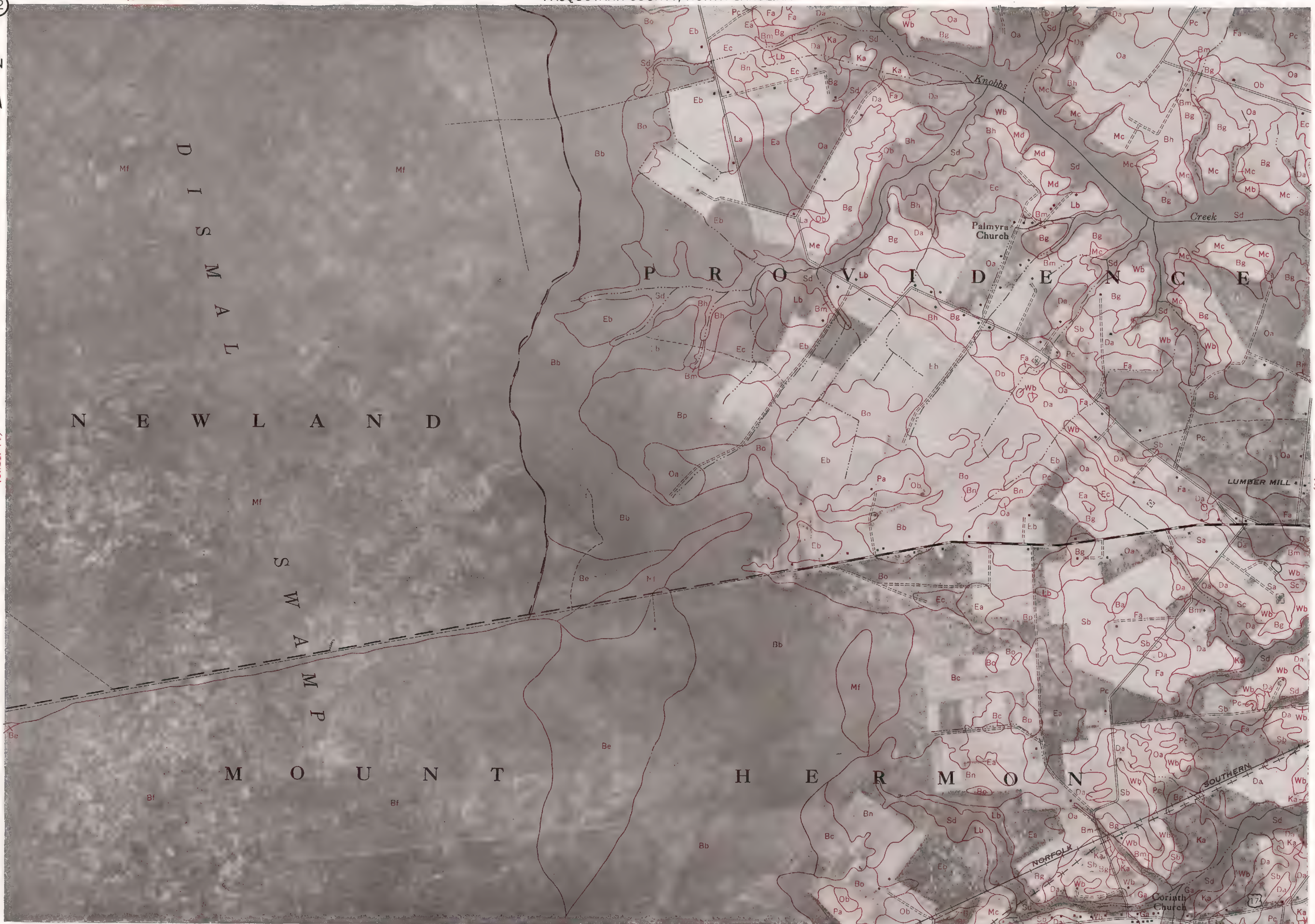


(Sheet 12)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

(Sheet 14)

N



(Sheet 11)
(Sheet 13)
(Sheet 15)

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

(Sheet 12)

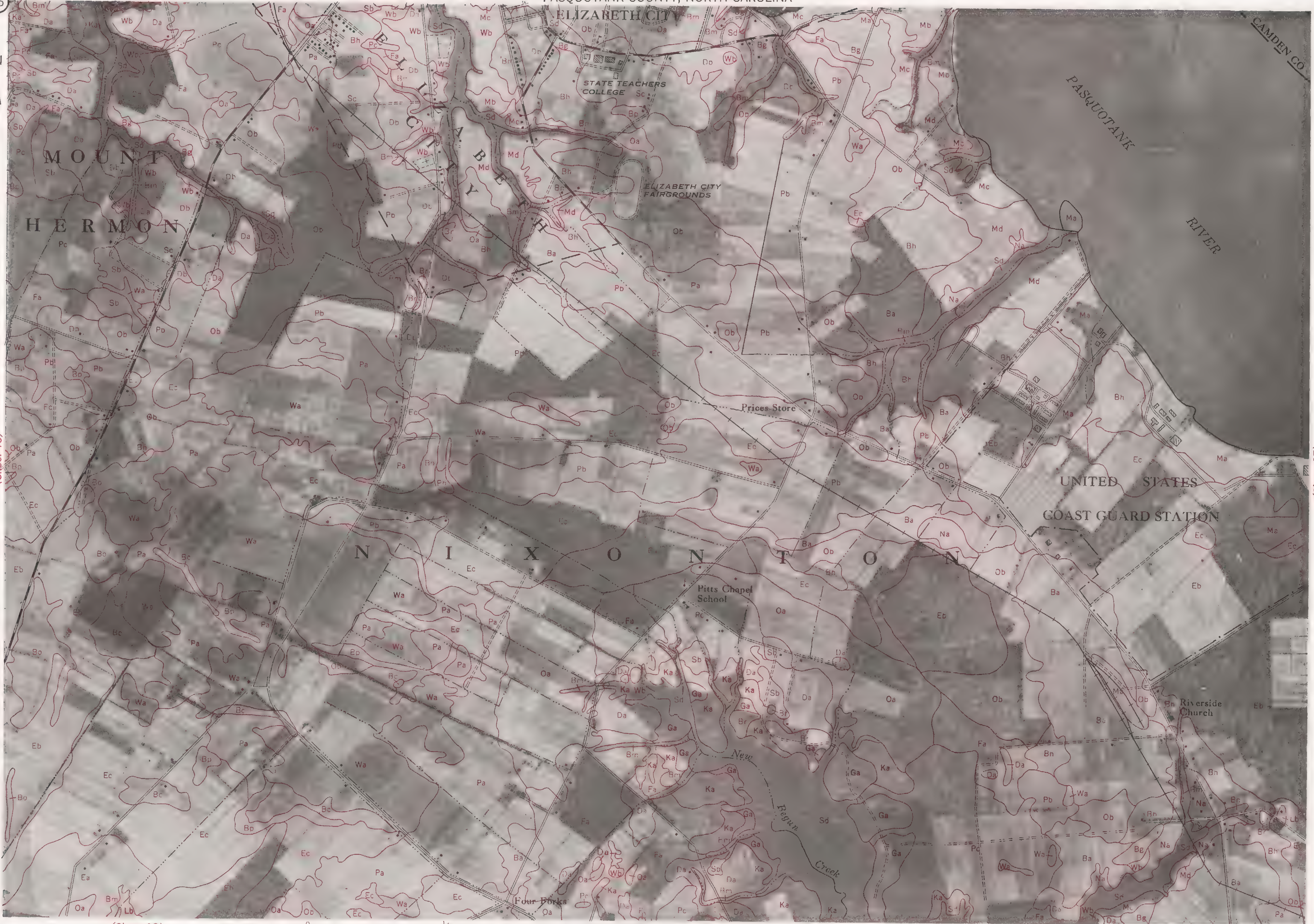
0 1/2 1 Mile
Scale 1:20 000
0 5000 Feet

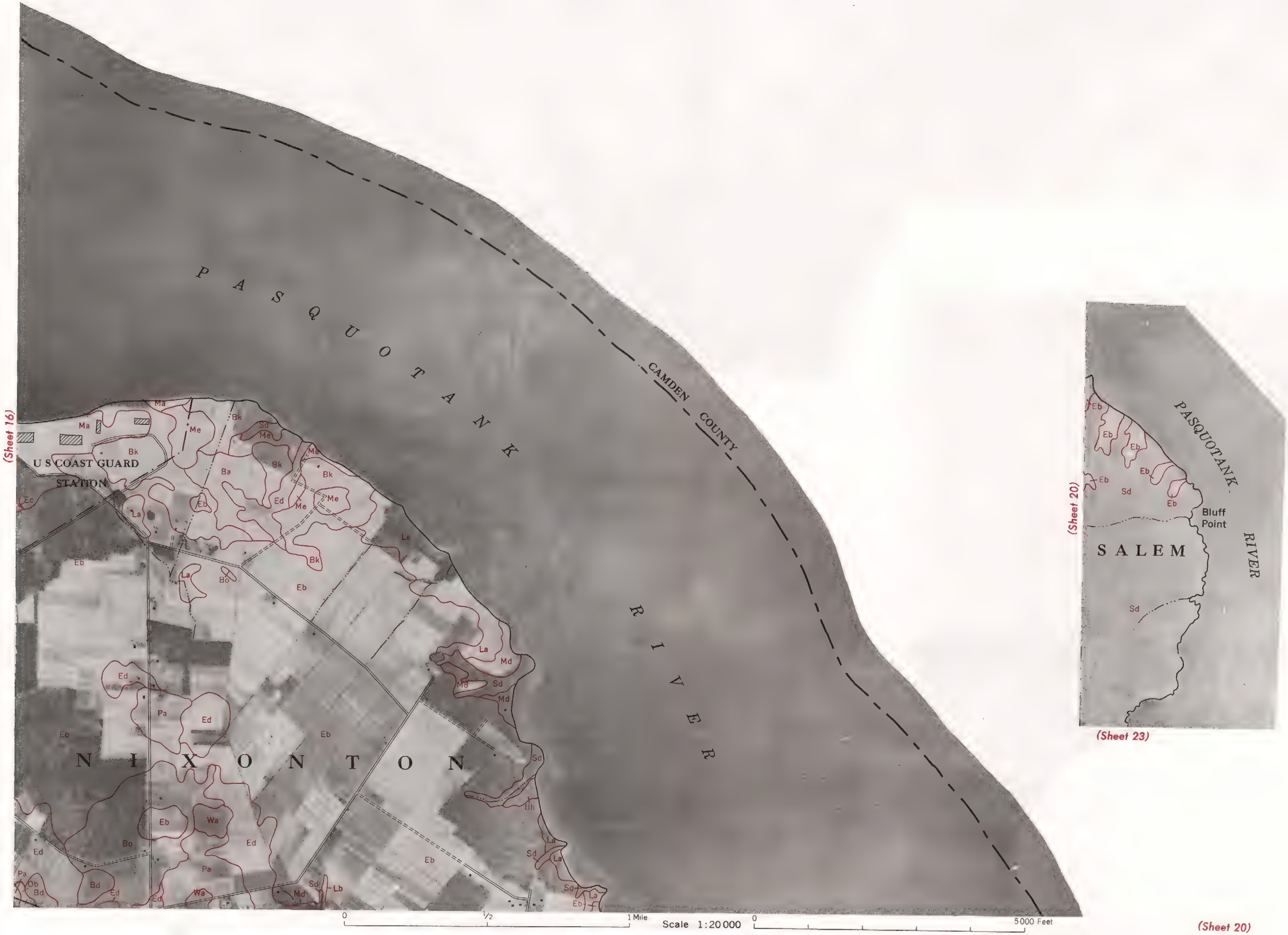
(Sheet 16)

N

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

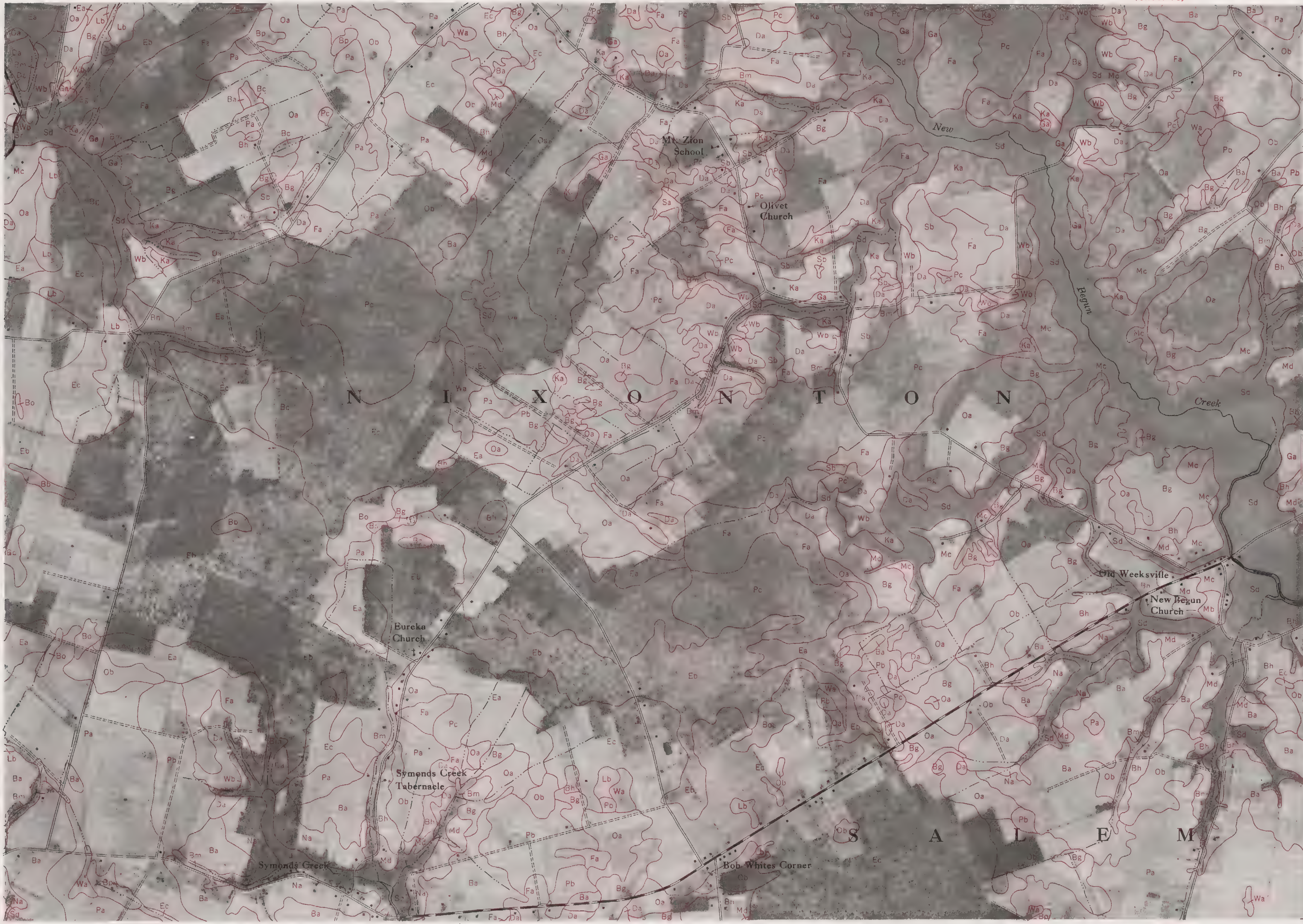
0 1/2 1 Mile Scale 1:20 000 0 5000 Feet


(Sheet 13)
N
ELIZABETH CITY
STATE TEACHERS COLLEGE
ELIZABETH CITY FAIRGROUNDS
CAMDEN CO
PASQUOTANK RIVER
MOUNT HERMON
ELIZABETH CITY
Prices Store
UNITED STATES COAST GUARD STATION
NIXONTON
Pitts Chapel School
Riverside Church
New Begun Creek
Four Forks
(Sheet 15)
(Sheet 17)
(Sheet 19)
0 1/2 1 Mile
Scale 1:20000
0 5000 Feet


N
PASQUOTANK RIVER
CAMDEN COUNTY
U S COAST GUARD STATION
NIXONTON
SALEM
Bluff Point
(Sheet 16)
(Sheet 20)
(Sheet 23)
(Sheet 20)
Scale 1:20 000
0
1/2
1 Mile
0
5000 Feet


(Sheet 15)
N
MOUNT HERMON
Little River
PERQUIMANS COUNTY
Halls Creek
Halls Creek Church
NIXONTON
LITTLE RIVER
Nixonton
Whiteville Grove School
Whiteville Grove Church
(Sheet 19)
(Sheet 18)
NIXONTON
Truebloods Point
LITTLE
PERQUIMANS COUNTY
RIVER
0
1/2
1 Mile
Scale 1:20 000
0
5000 Feet
(Inset)

(Sheet 18)



(Sheet 20)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Sheet 21)

(Sheet 17)

(Sheet 19)

(Inset Sheet 17)

(Sheet 22)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Inset Sheet 18)

(Sheet 22)

(Sheet 24)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

(Sheet 20)

(Sheet 21)

(Sheet 23)

1 Mile
Scale 1:20 000
0
5000 Feet

(Sheet 25)


(Inset Sheet 17)
(Sheet 22)
N
Bank Point
LITTLE FLATTY CR
PASQUOTANK RIVER
Little Bethany Church
SALEM
Gray Swamp
Wade Point
ALBEMARLE SOUND
Sd
Ba
Bh
Lb
Eb
Ob
Pb
Ec
Scale 1:20000
0
1/2
1 Mile
0
5000 Feet

N

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

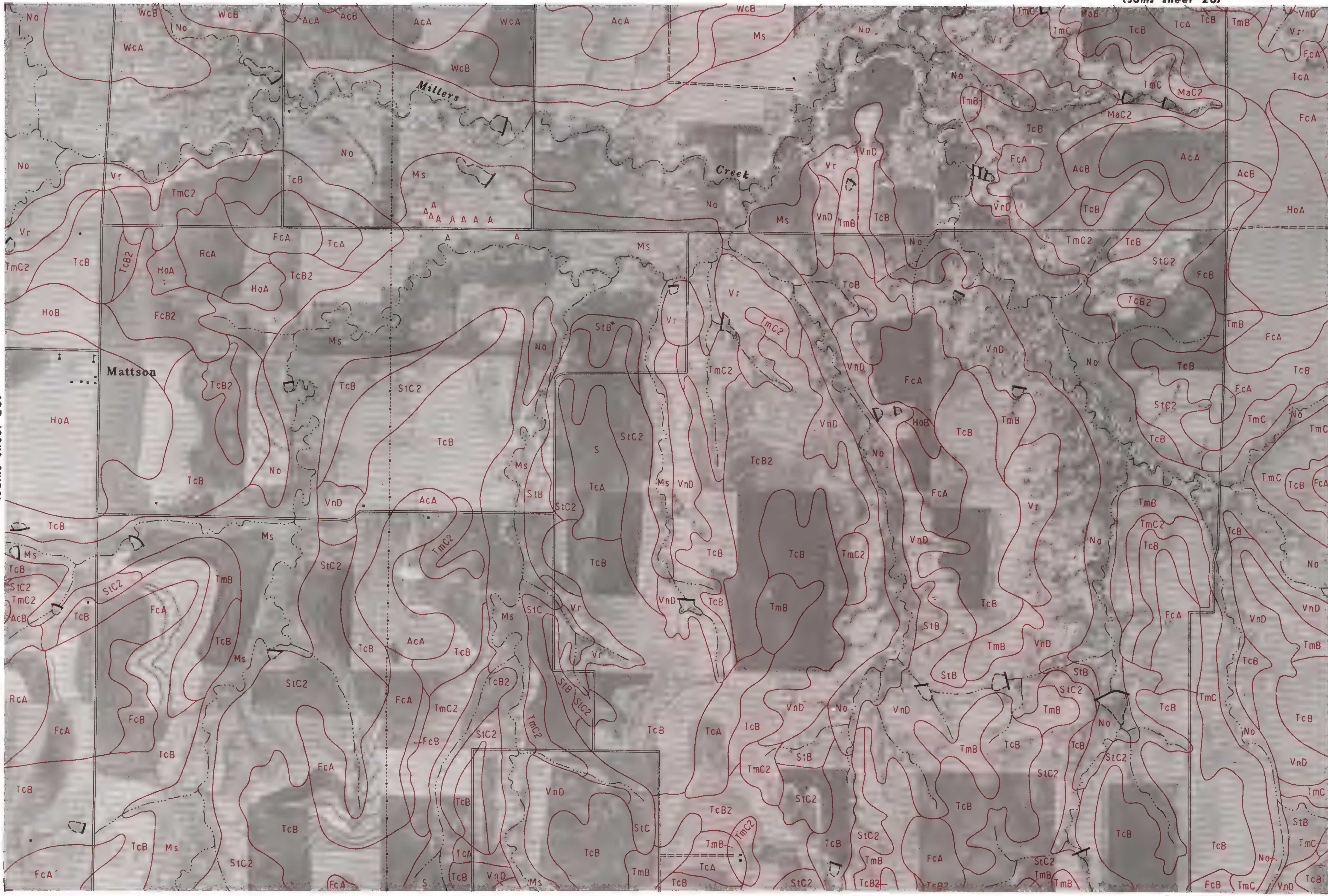

Listers Corner
S A L E M
BIG FLATTY CREEK
S A L E M
FROG ISLAND FISHING CLUB
N
A L B E M A R L E S O U N D
(Sheet 24)
0 1/2 1 Mile
Scale 1:20 000
0 5000 Feet

HASKELL COUNTY, TEXAS - SHEET NUMBER 26

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 20)

(Joins sheet 26)



(Joins sheet 28)

(Joins sheet 34)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

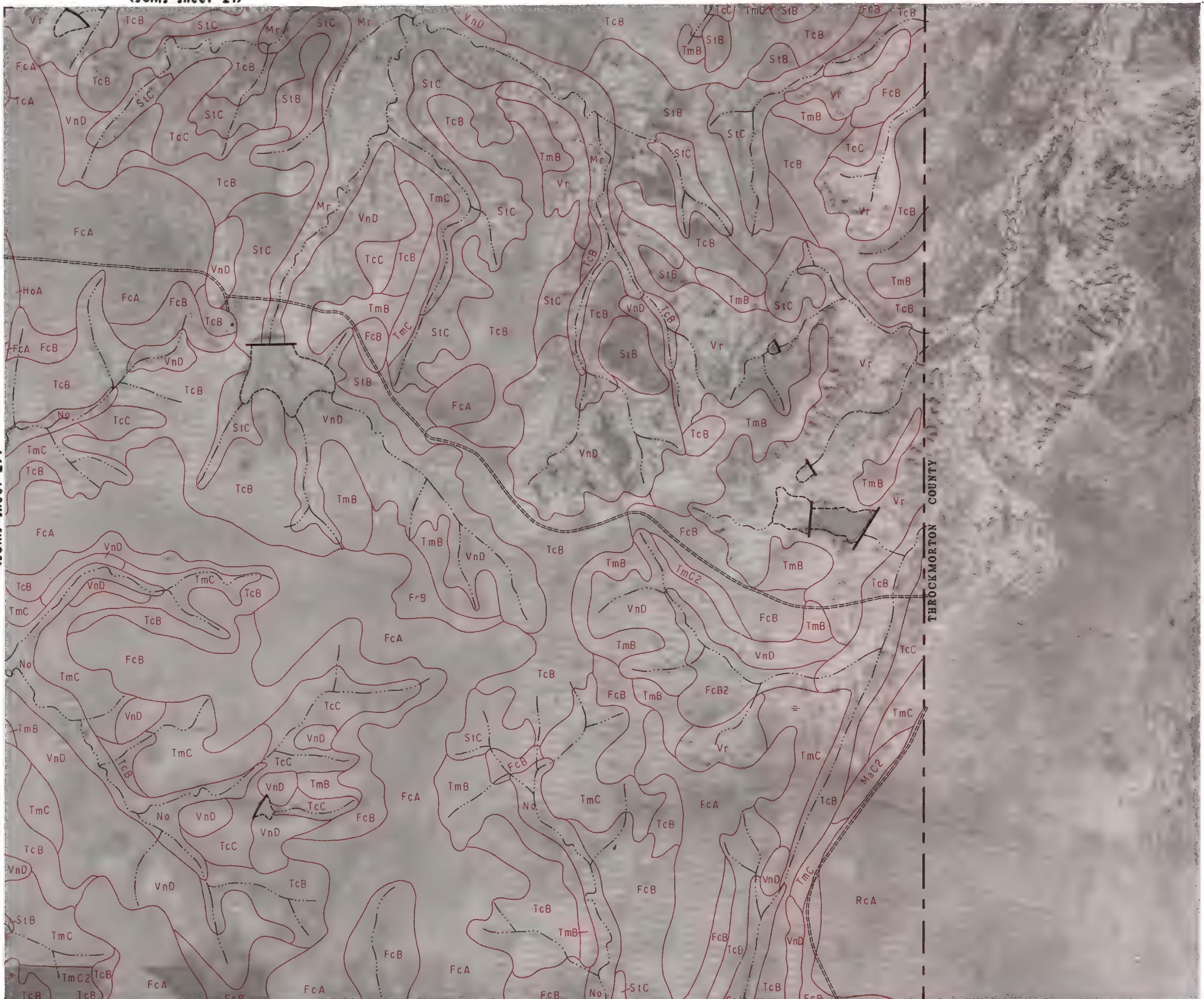
This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

28

(Joins sheet 21)

N

(Joins sheet 27)



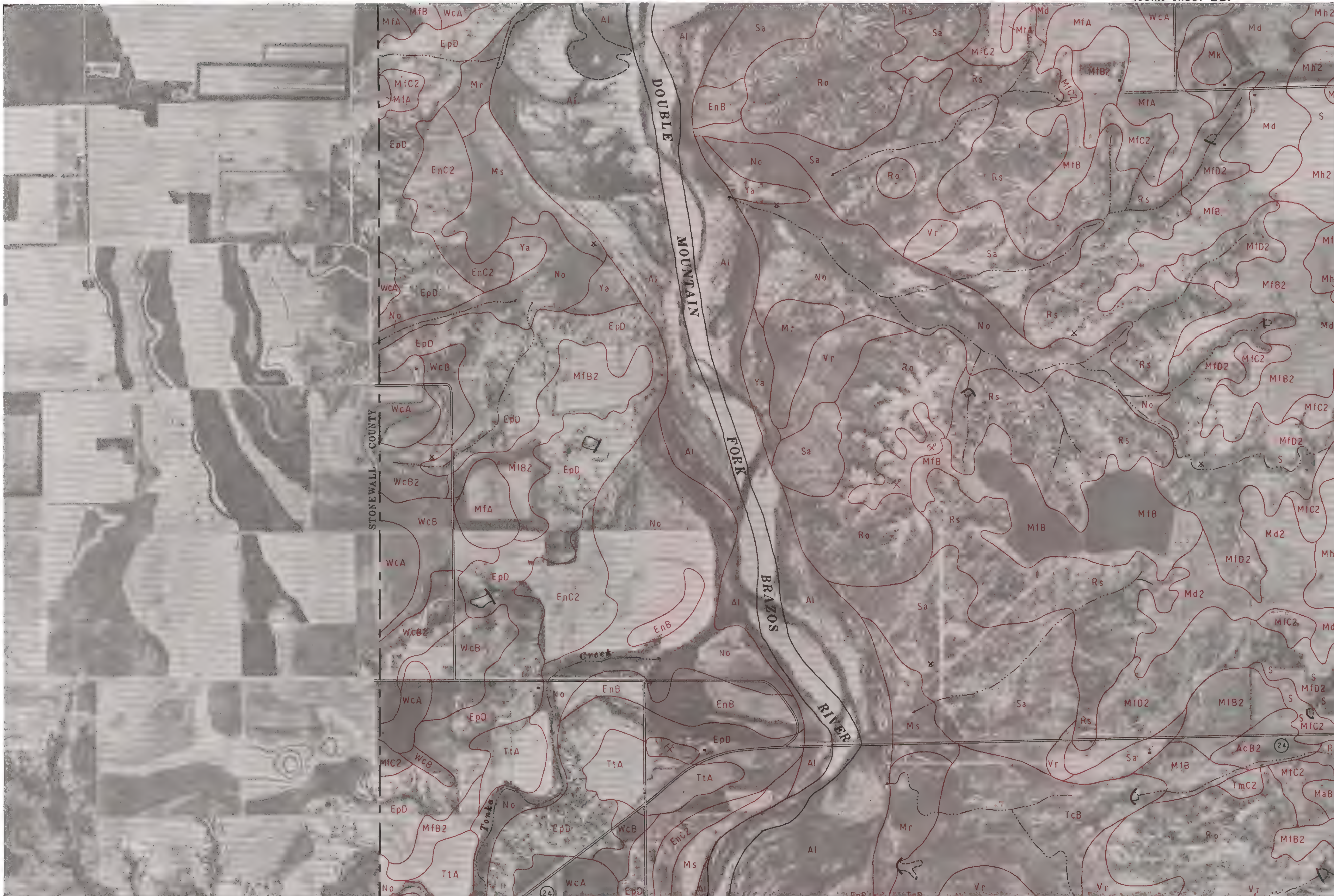
(Joins sheet 35)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 22)

29

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.



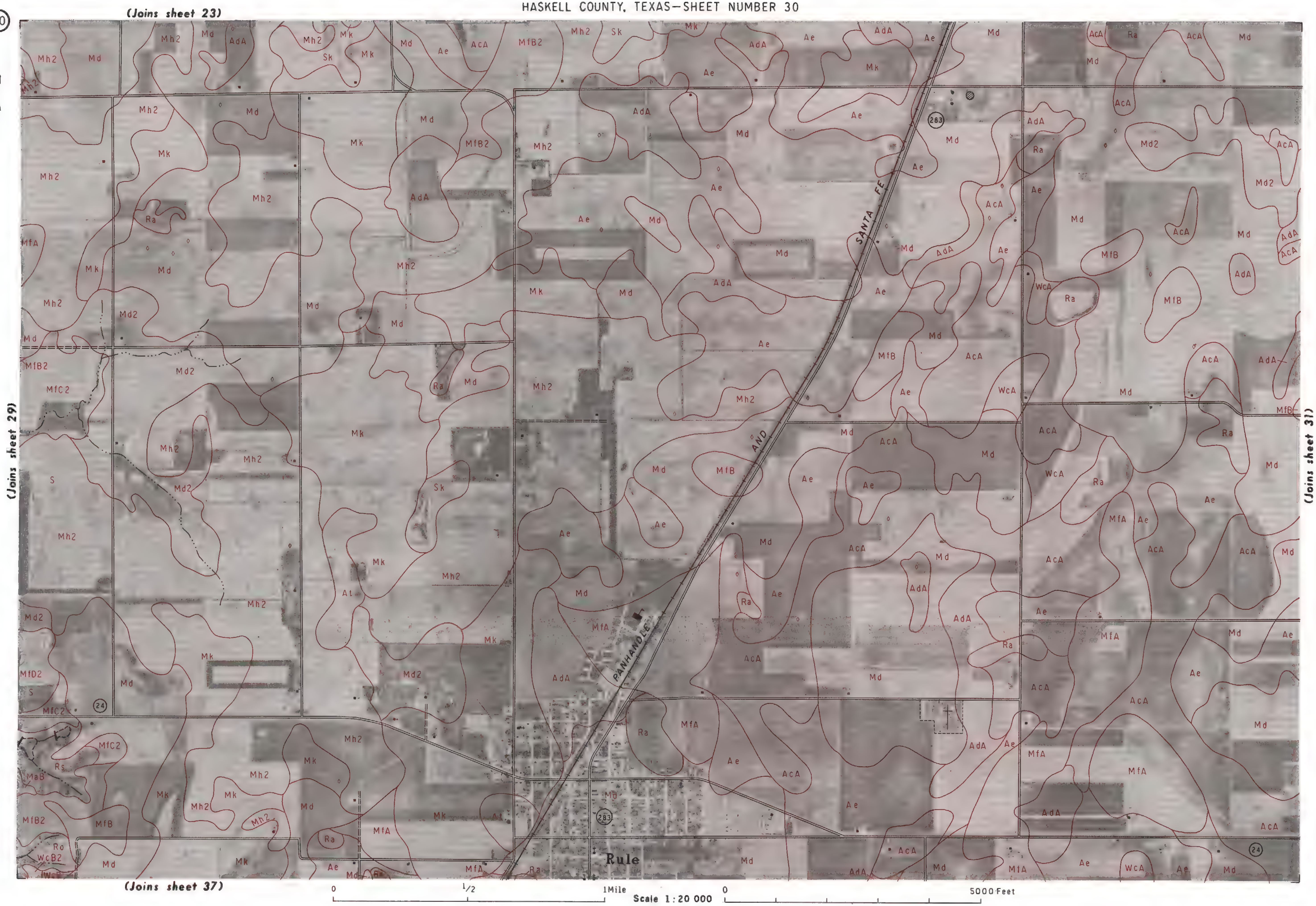
(Joins sheet 30)

(Joins sheet 36)

0 1/2 1 Mile

Scale 1:20 000

0 5000 Feet


(Joins sheet 23)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 37)
N
SANTA FE
AND
PANHANDLE
Rule
283
24
0
1/2
1 Mile
Scale 1:20 000
0
5000 Feet

(Joins sheet 24)

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 38)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

HASKELL COUNTY, TEXAS—SHEET NUMBER 32

32

(Joins sheet 25)

N

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 39)

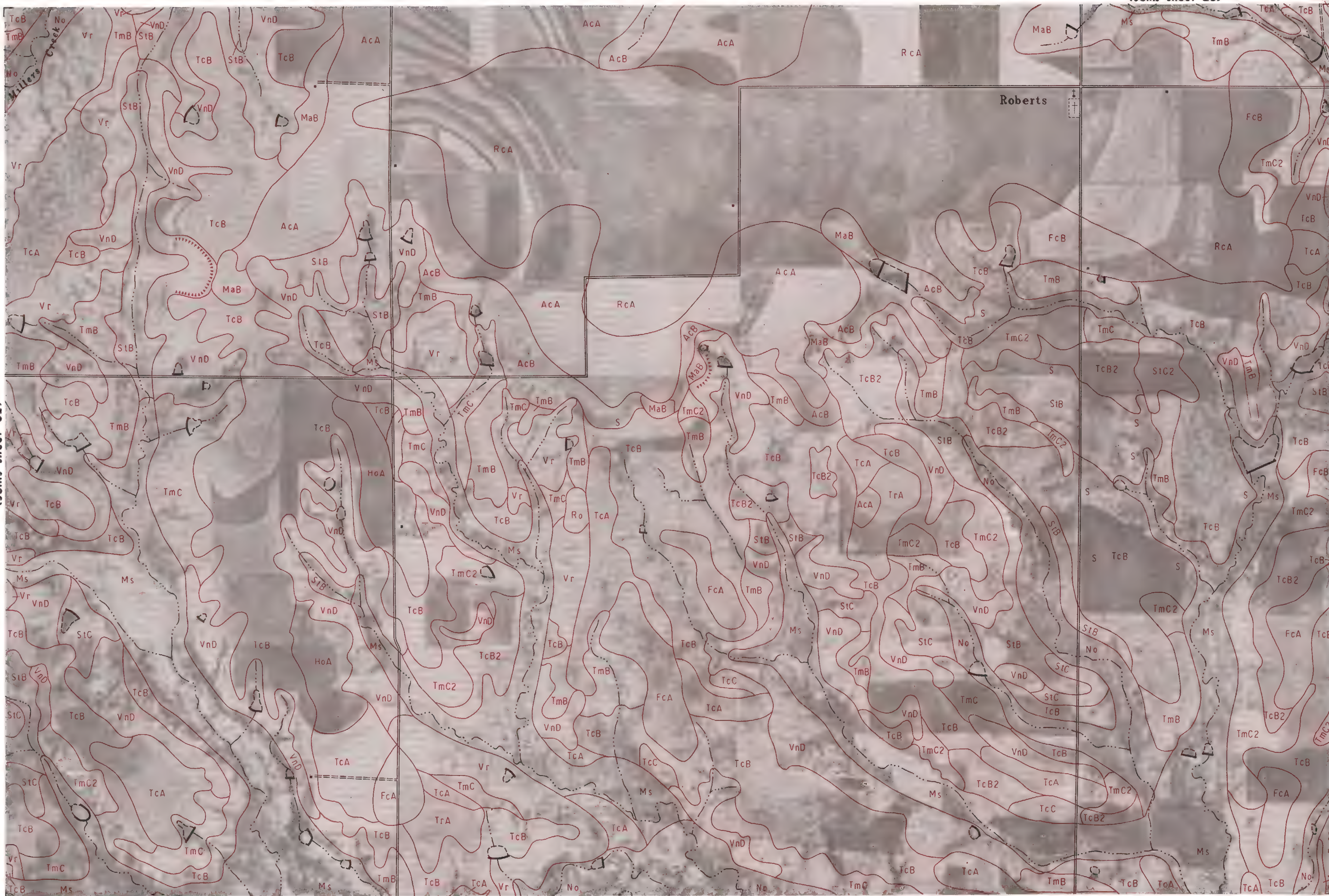
0 1/2 1 Mile

Scale 1:20 000

0 5000 Feet

(Joins sheet 26)

(Joins sheet 32)



(Joins sheet 34)

(Joins sheet 40)

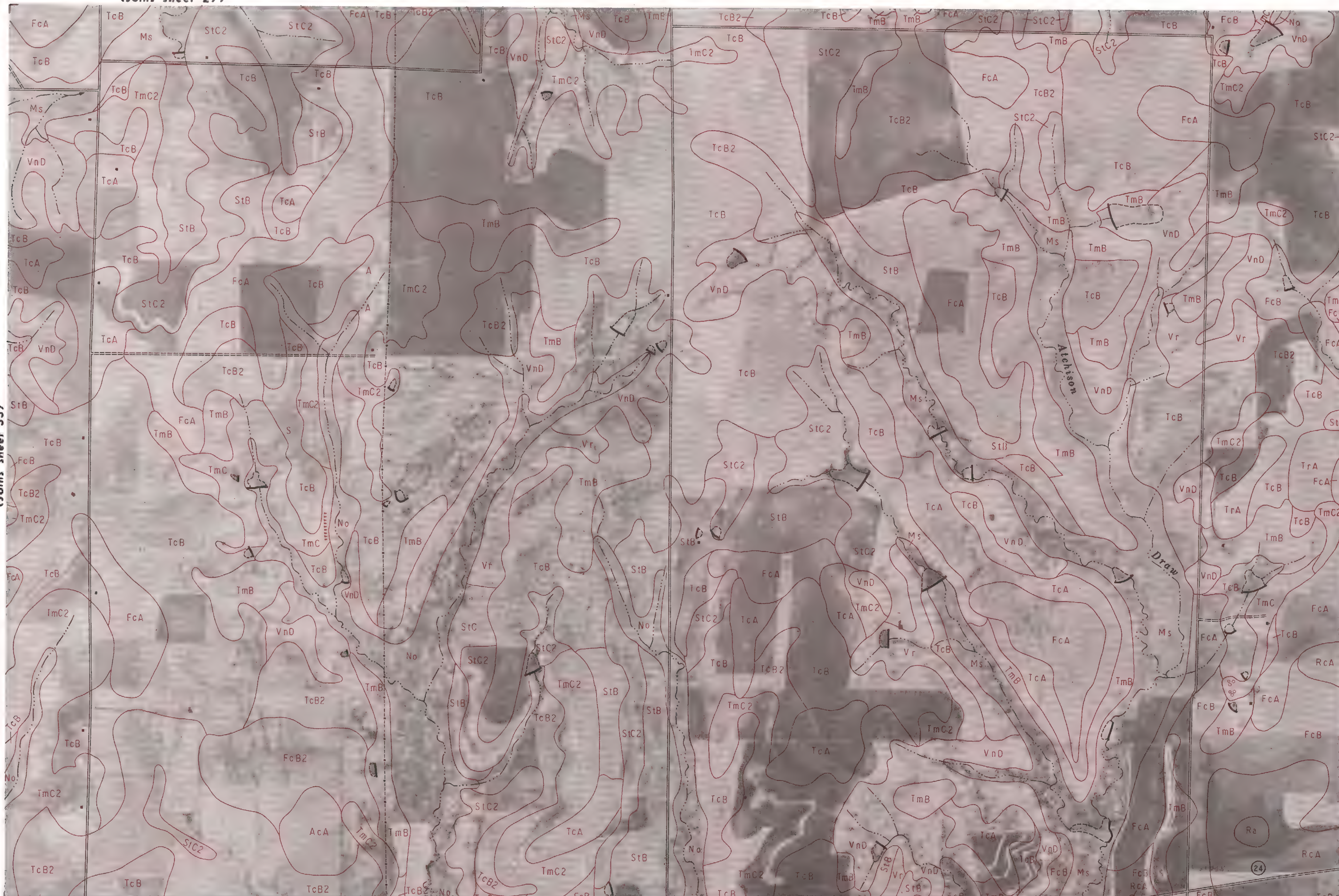
0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

HASKELL COUNTY, TEXAS—SHEET NUMBER 34

(Joins sheet 27)

(Joins sheet 33)



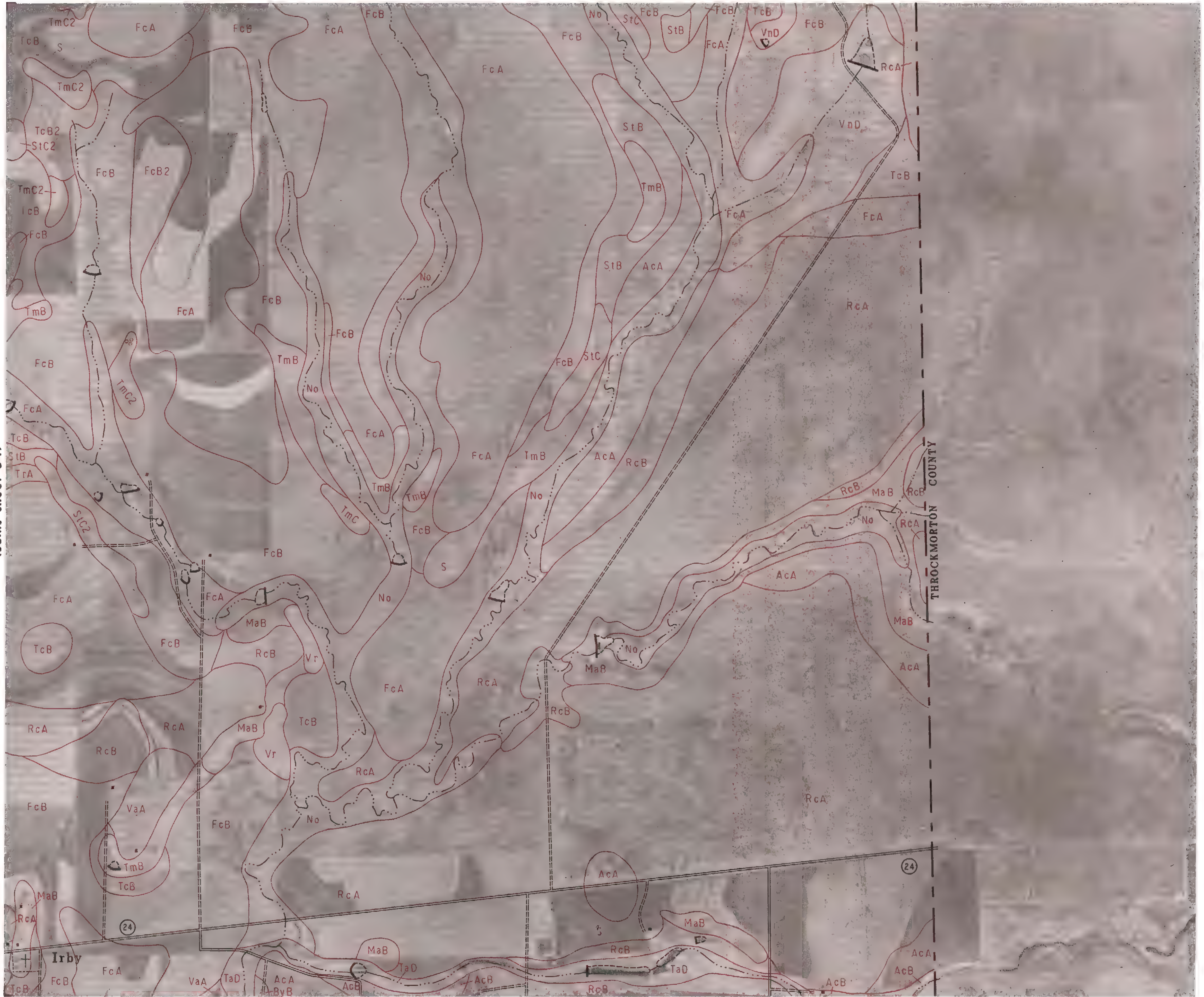
(Joins sheet 33)

(Joins sheet 41)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 28)

(Joins sheet 34)



(Joins sheet 42)

0 1/2 1Mile Scale 1:20 000 0 5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

(Joins sheet 29)

(Joins sheet 37)

(Joins sheet 43)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 30)

37

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 44)

0 1/2 1 Mile

Scale 1:20 000

0 5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

(Joins sheet 31)

(Joins sheet 37)

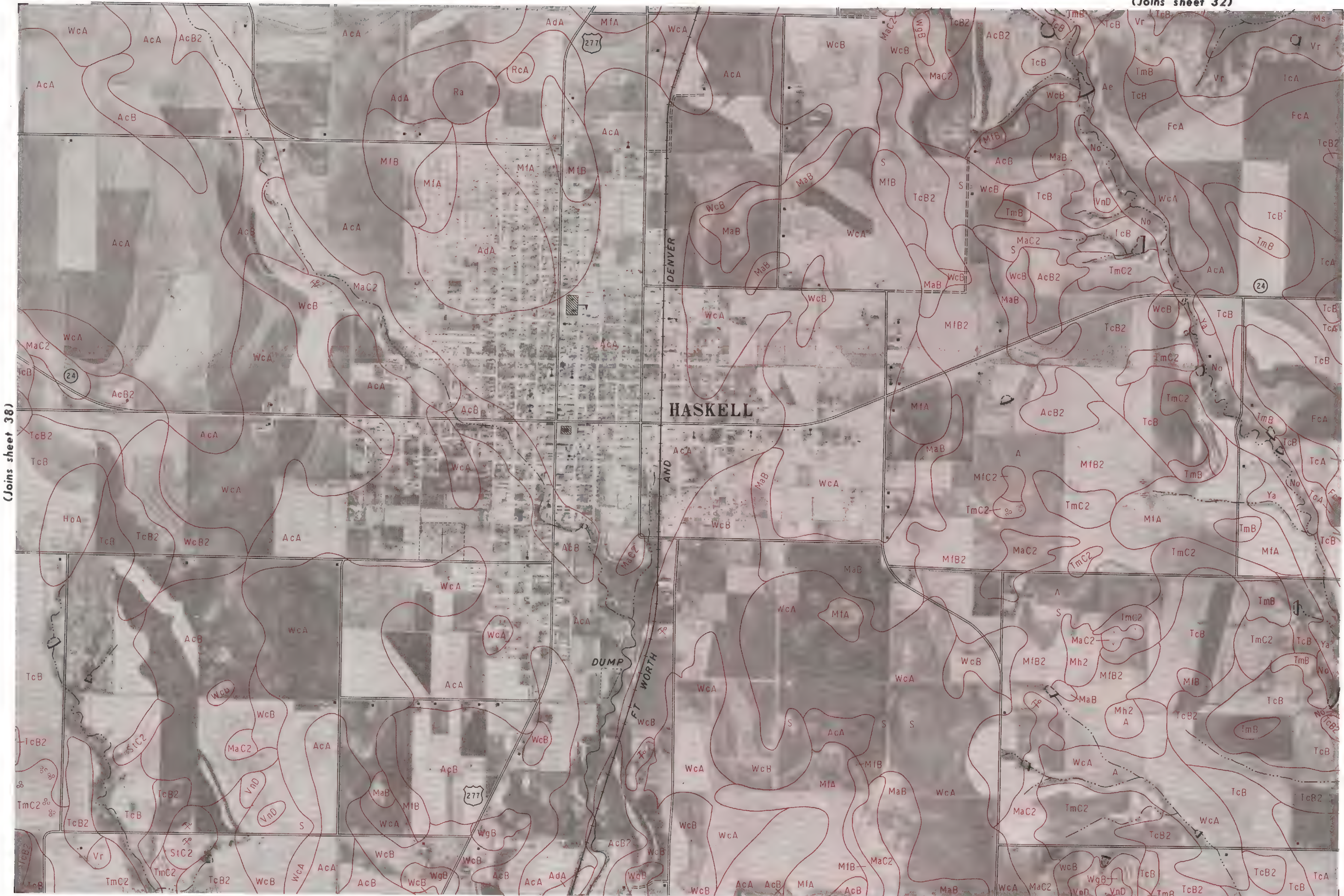
(Joins sheet 39)

(Joins sheet 45)

0 1/2 1 Mile Scale 1 : 20 000 0 5000 Feet

(Joins sheet 32)

(Joins sheet 38)



(Joins sheet 40)

(Joins sheet 46)

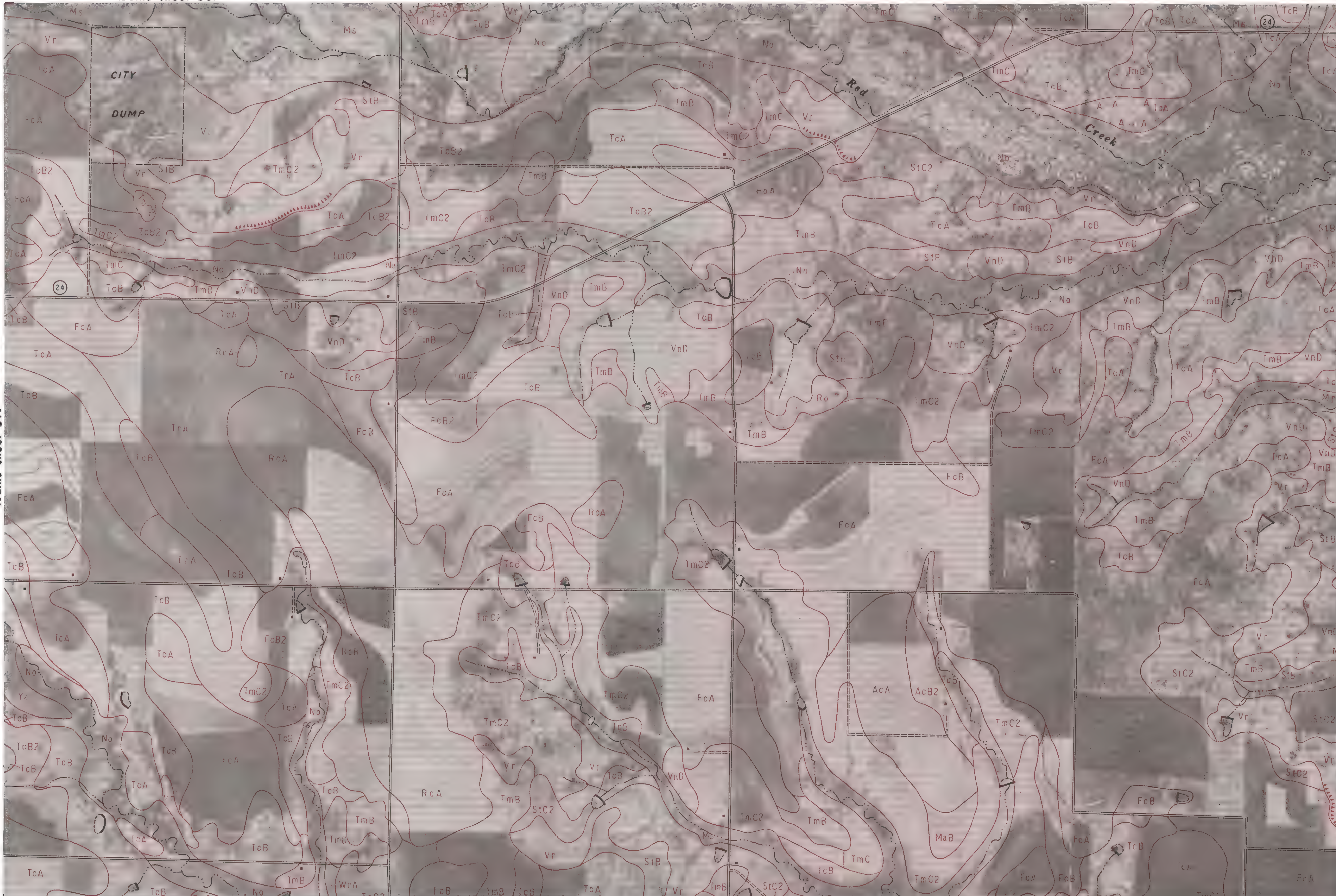
0 1/2 1Mile
Scale 1:20 000
0 5000Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

(Joins sheet 33)

N

(Joins sheet 39)



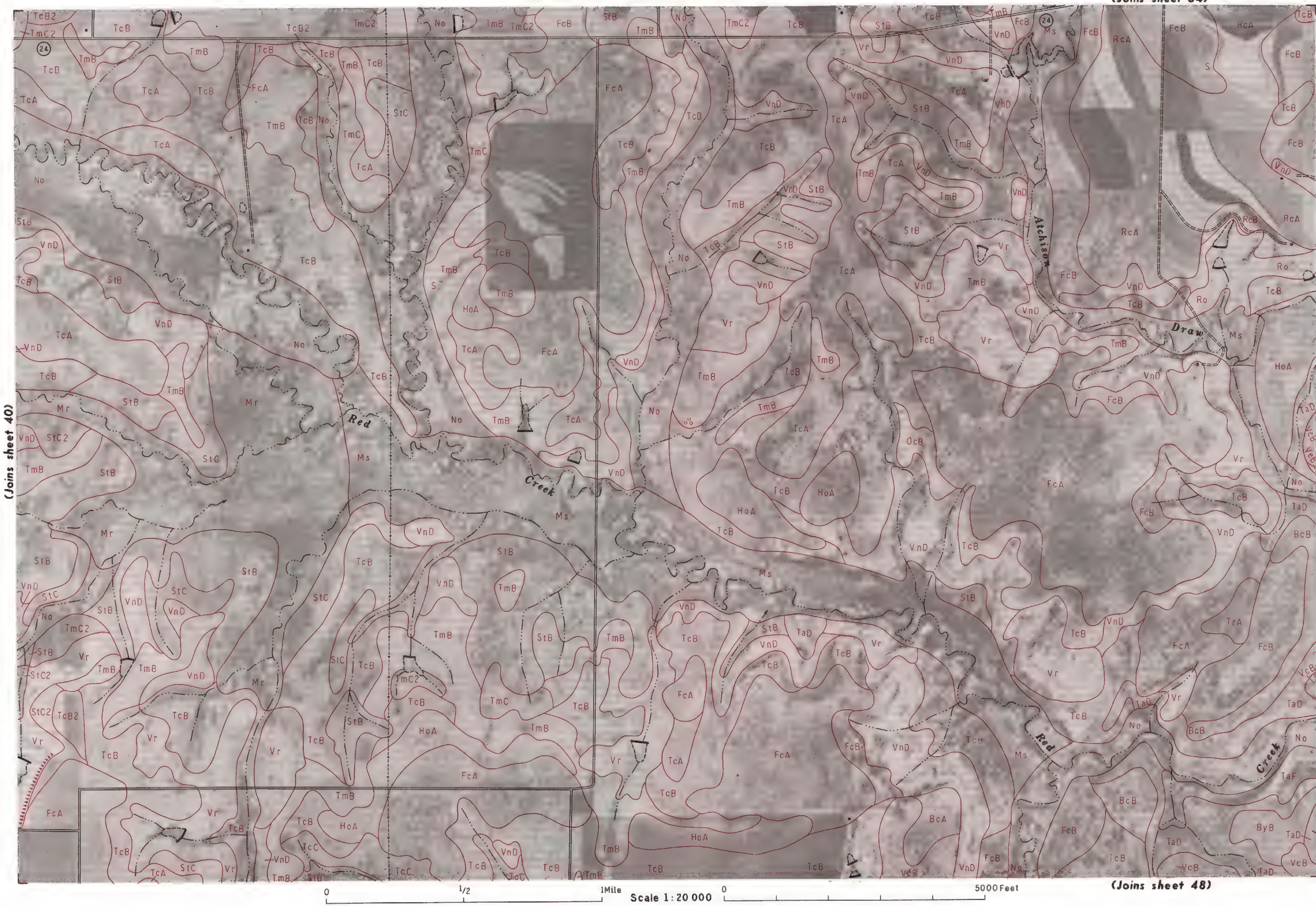
(Joins sheet 41)

(Joins sheet 47)

0 1/2 1 Mile

Scale 1:20 000

0 5000 Feet

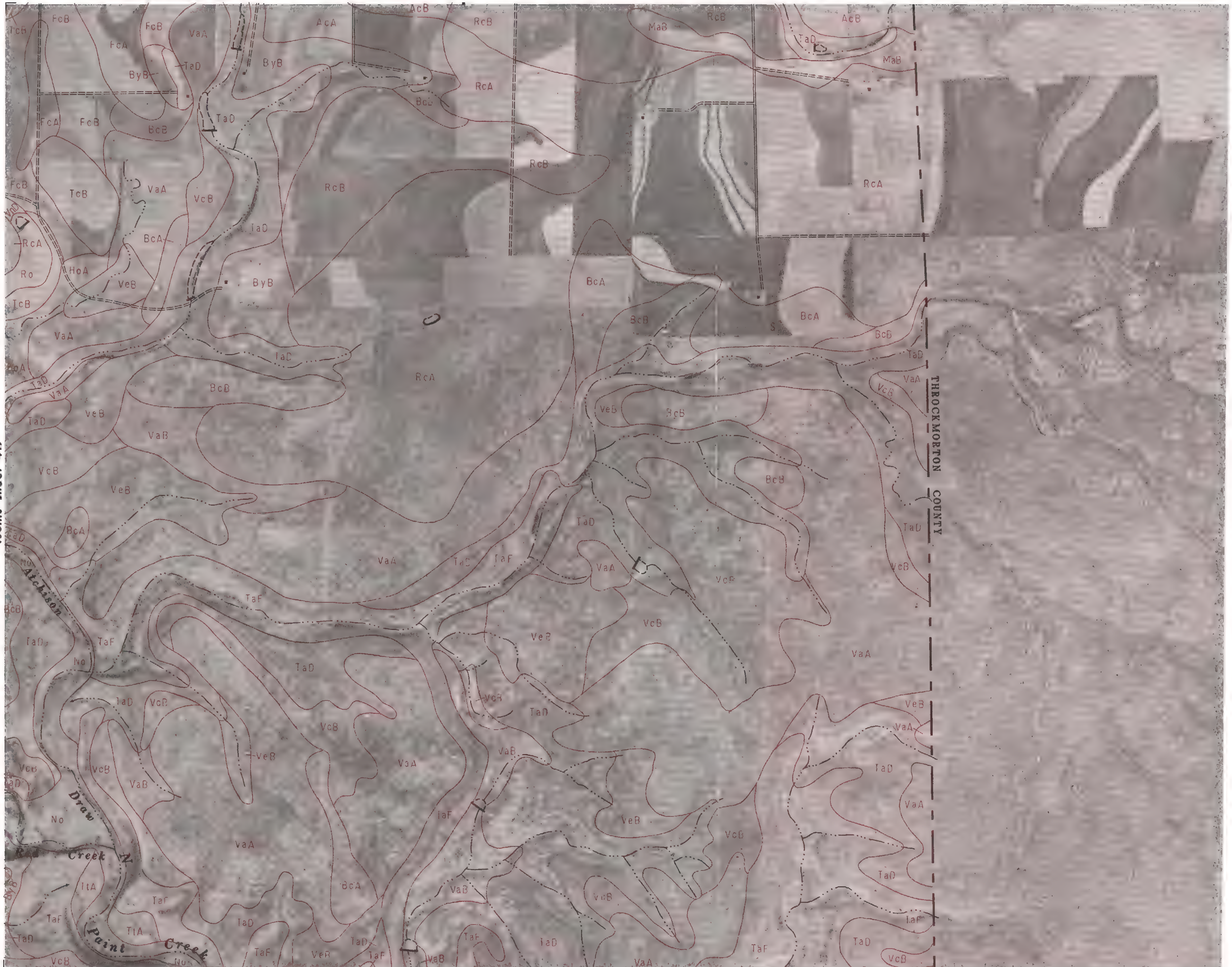


This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

HASKELL COUNTY, TEXAS—SHEET NUMBER 42

(Joins sheet 35)

(Joins sheet 41)



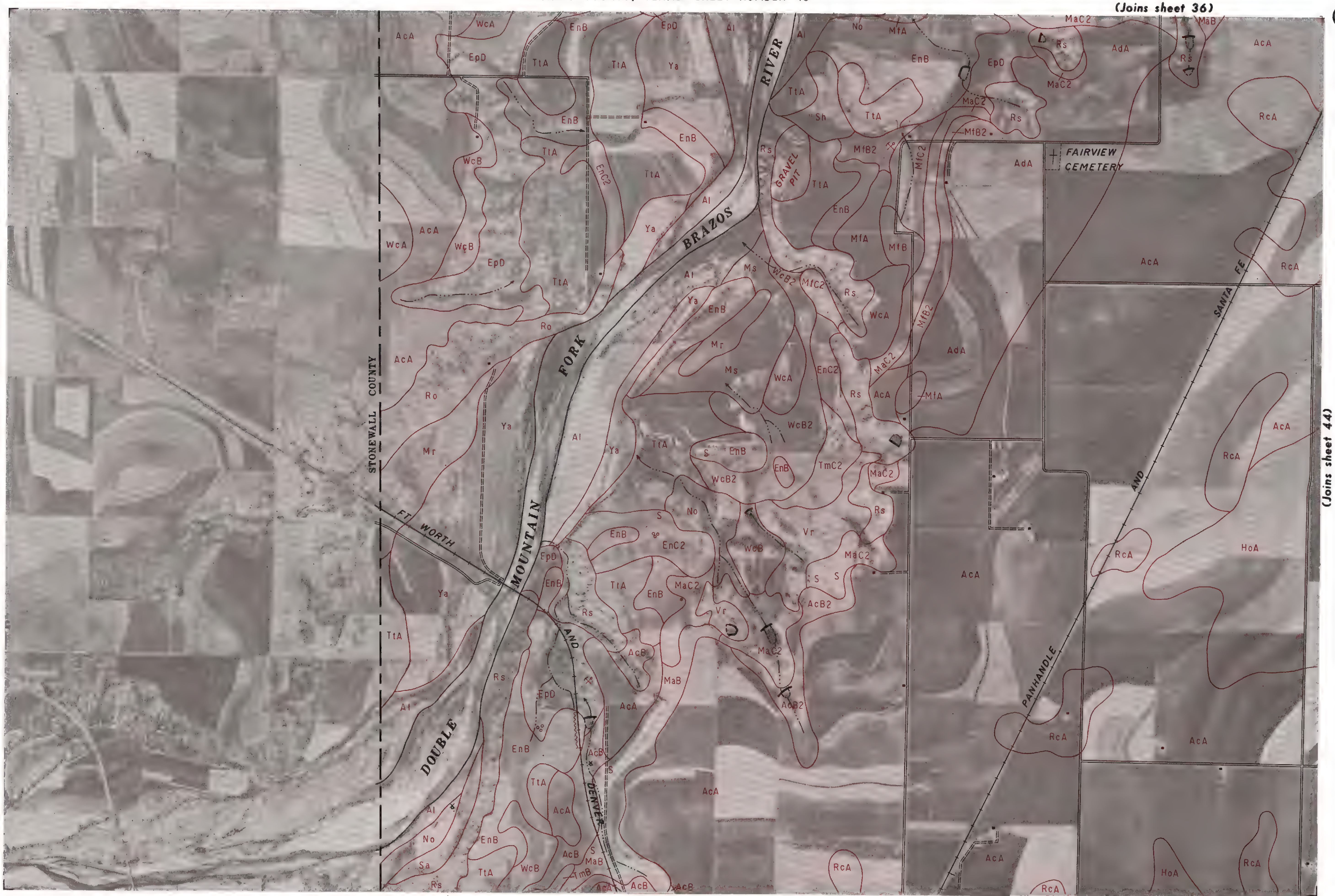
(Joins sheet 49)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 36)

43

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.



(Joins sheet 44)

(Joins sheet 50)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

44

(Joins sheet 37)

(Joins sheet 43)

(Joins sheet 45)

(Joins sheet 51)

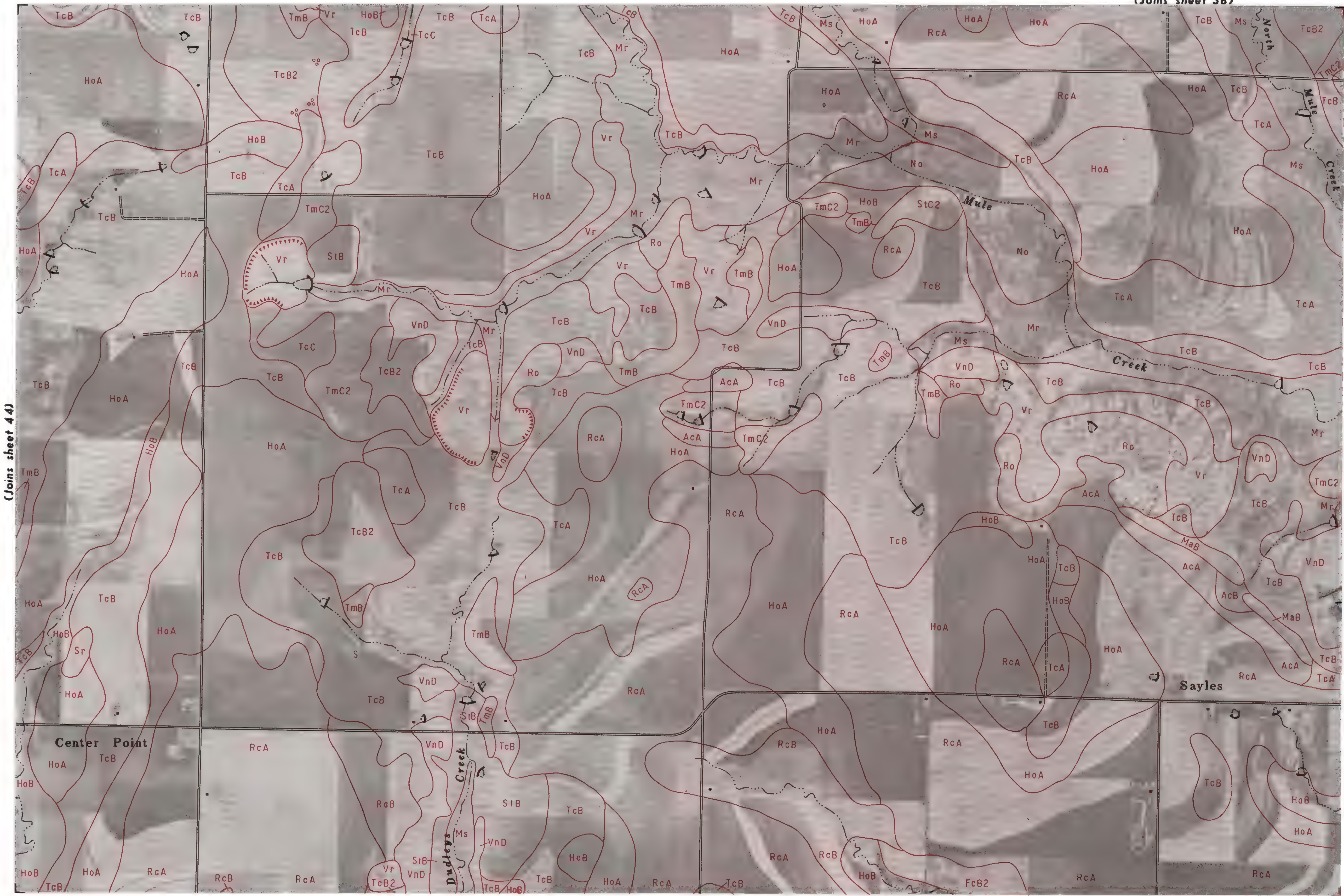
0 1/2 1 Mile

Scale 1:20 000

0 5000 Feet

(Joins sheet 38)

(Joins sheet 44)



(Joins sheet 46)

(Joins sheet 52)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

HASKELL COUNTY, TEXAS—SHEET NUMBER 46

(Joins sheet 39)

(Joins sheet 45)

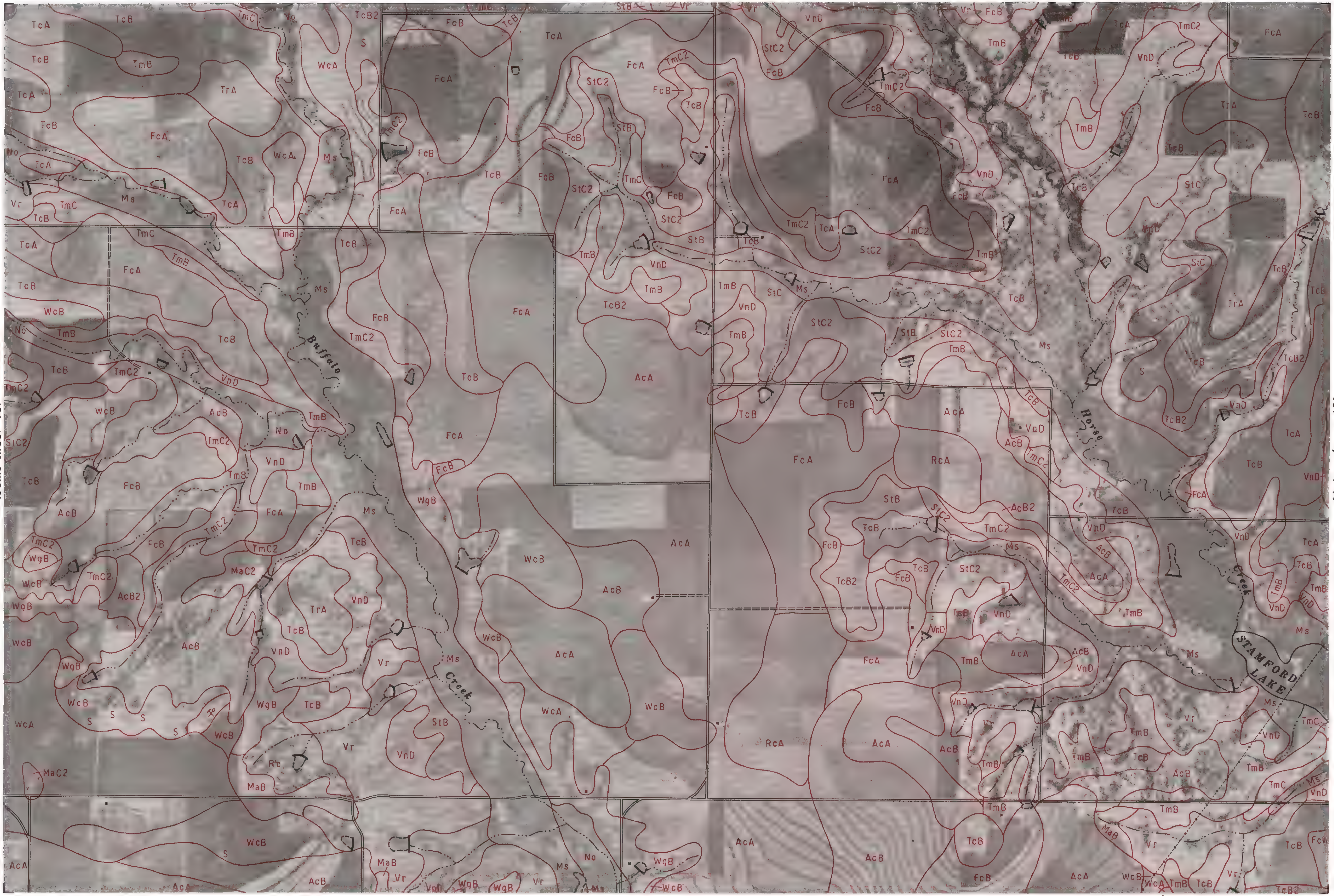
(Joins sheet 47)

(Joins sheet 53)

0 1/2 1 Mile
Scale 1:20 000
0 5000 Feet

(Joins sheet 40)

47



(Joins sheet 46)

(Joins sheet 48)

(Joins sheet 54)

0 1/2 1 Mile Scale 1: 20 000 0 5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

48

HASKELL COUNTY TEXAS—SHEET NUMBER 48

(Joins sheet 41)

N

(Joins sheet 47)

(Joins sheet 49)

(Joins sheet 55)

0 1/2 1 Mile

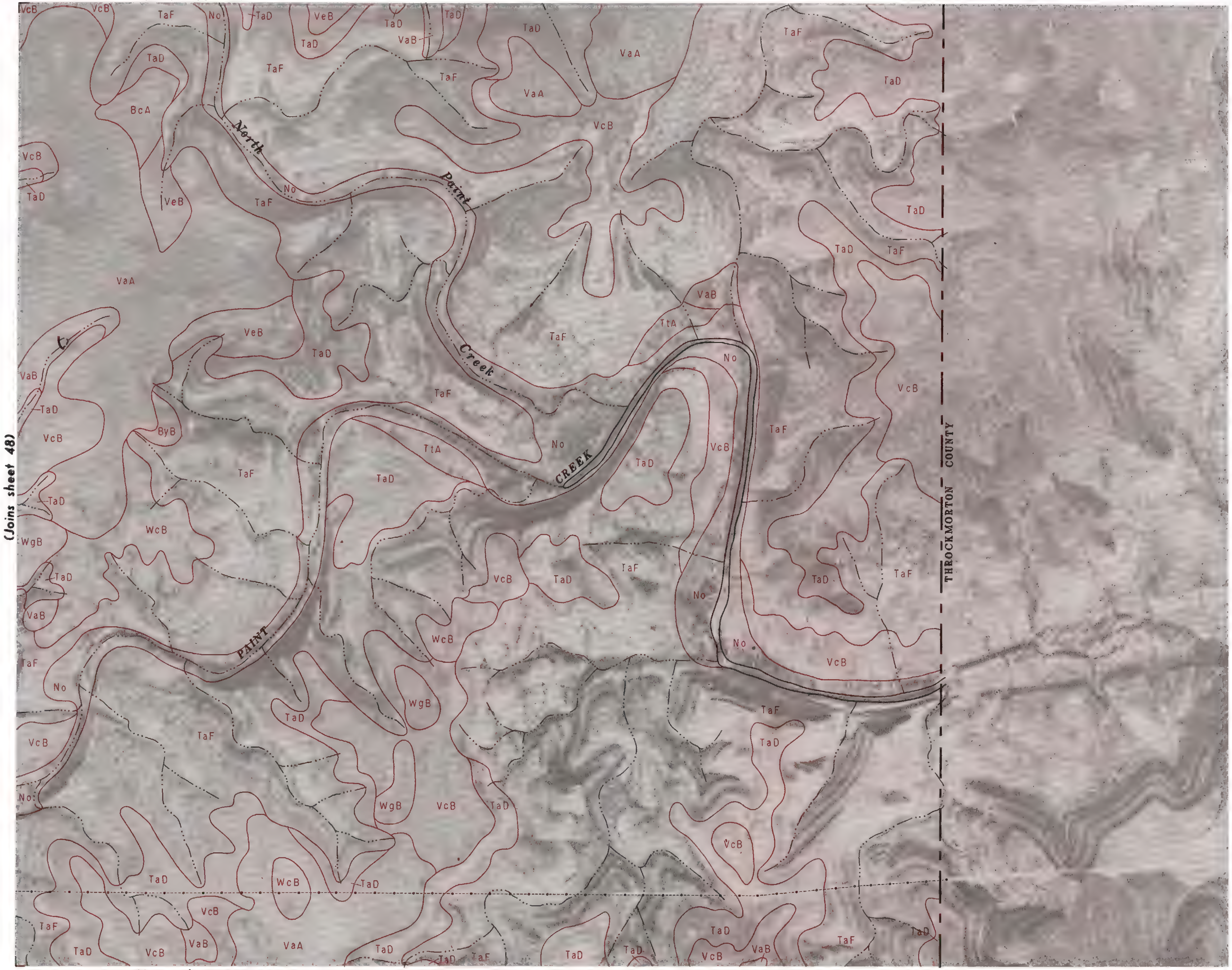
Scale 1:20 000

0 5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

(Joins sheet 42)

(Joins sheet 48)



(Joins sheet 56)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

N

(Joins sheet 43)

(Joins sheet 51)

Scale 1:20 000

0 1/2 1 Mile

0 5000 Feet

(Joins sheet 57)

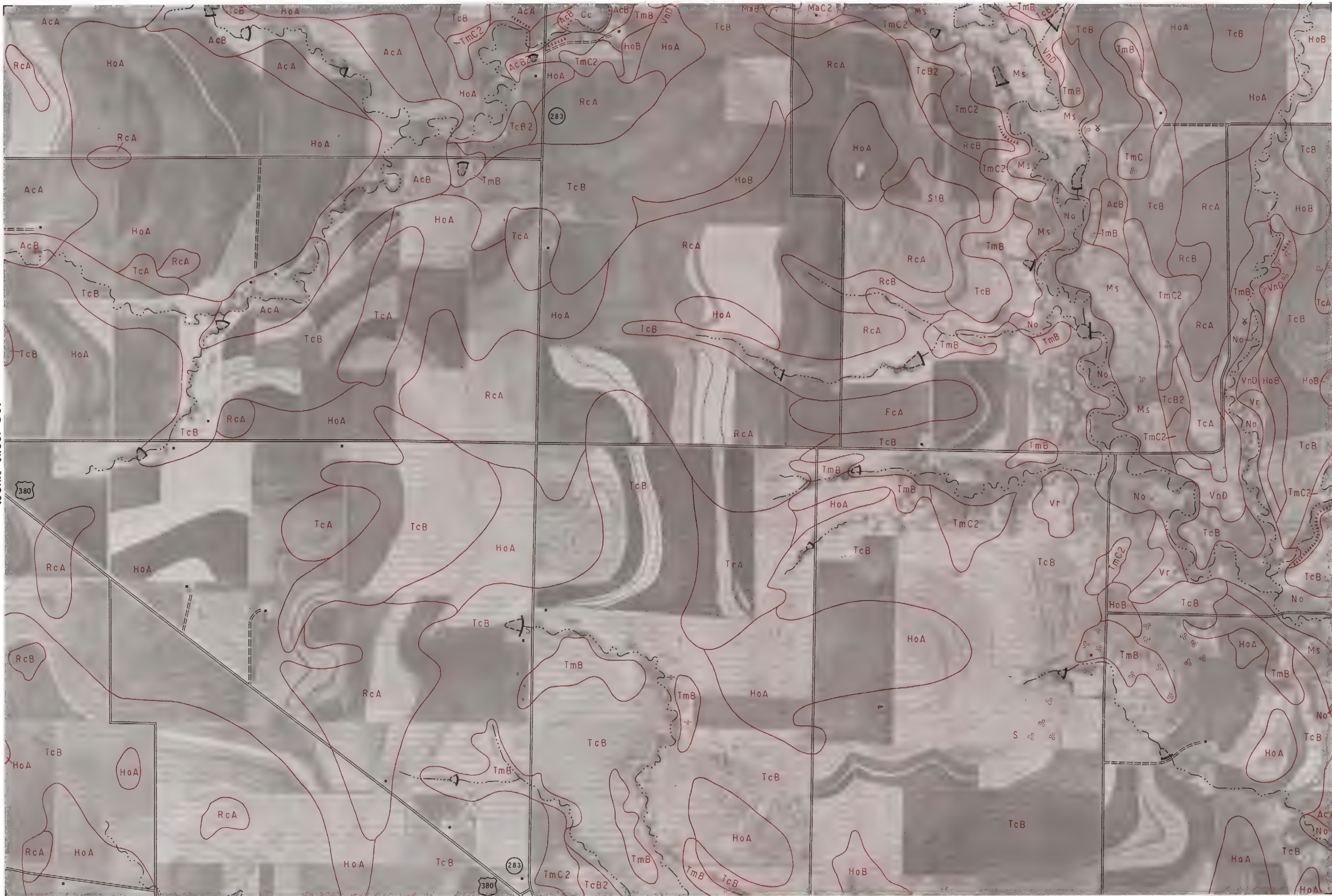
HASKELL COUNTY, TEXAS – SHEET NUMBER 51

(51)

(Joins sheet 44)

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

(Joins sheet 50)



(Joins sheet 52)

(Joins sheet 58)

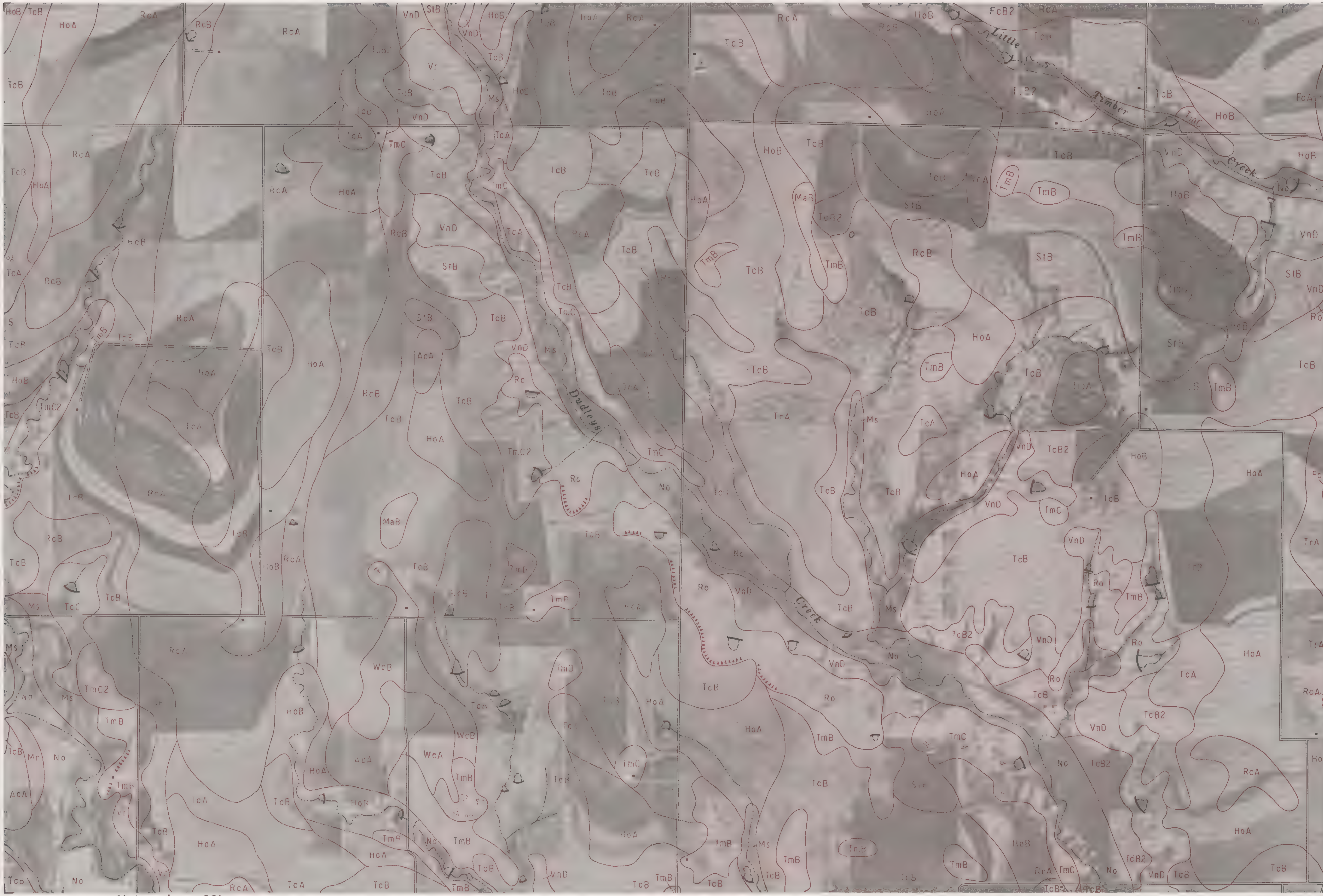
0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

HASKELL COUNTY, TEXAS - SHEET NUMBER 52

(Joins sheet 45)

N

(Joins sheet 51)



(Joins sheet 53)

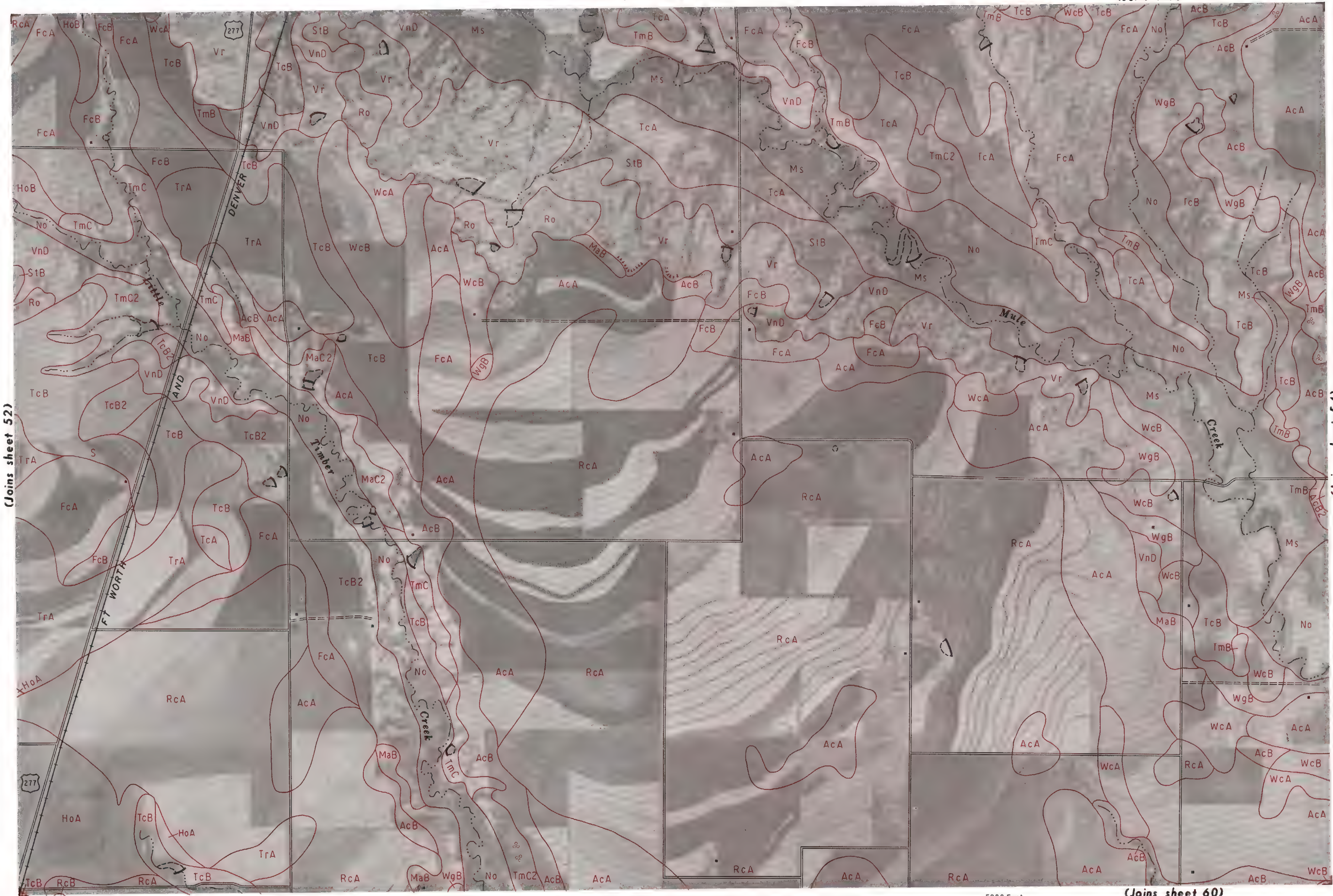
(Joins sheet 59)

0 1/2 1 Mile

Scale 1:20 000

0 5000 Feet

(Joins sheet 46)

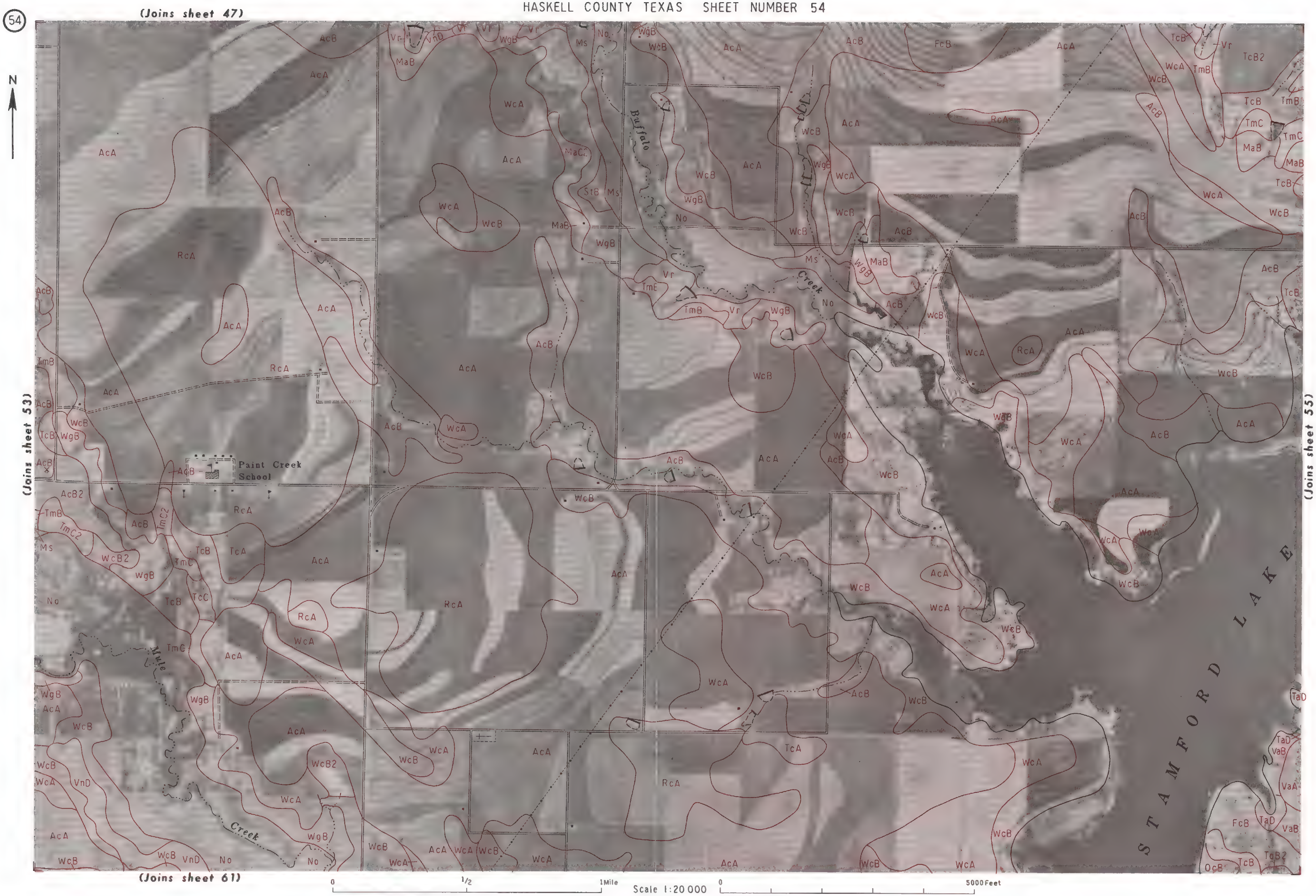


(Joins sheet 60)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

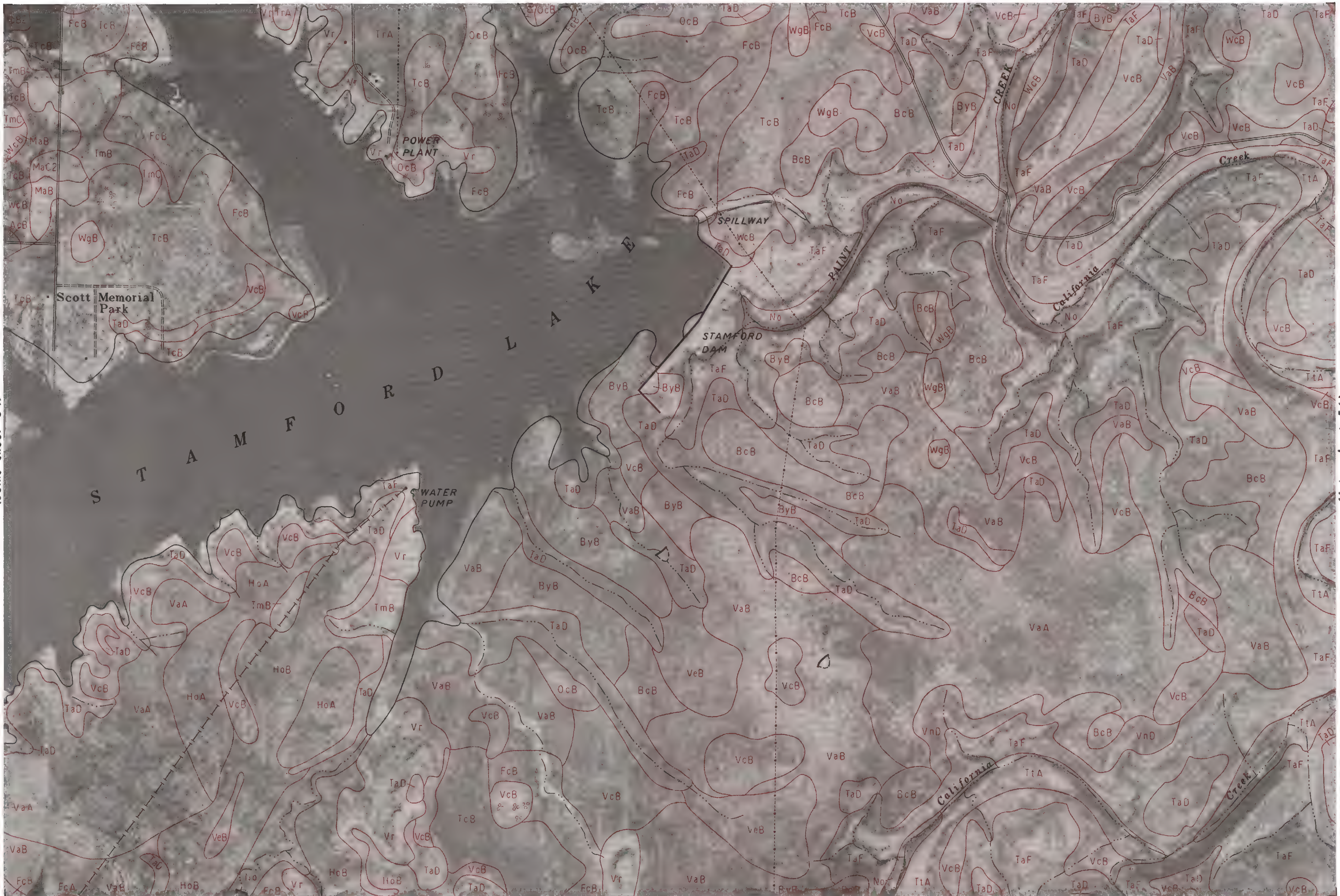
This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

HASKELL COUNTY TEXAS SHEET NUMBER 54



(55)

(Joins sheet 48)



(Joins sheet 54)

(Joins sheet 56)

(Joins sheet 62)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

HASKELL COUNTY, TEXAS - SHEET NUMBER 56

(Joins sheet 49)

N

(Joins sheet 55)

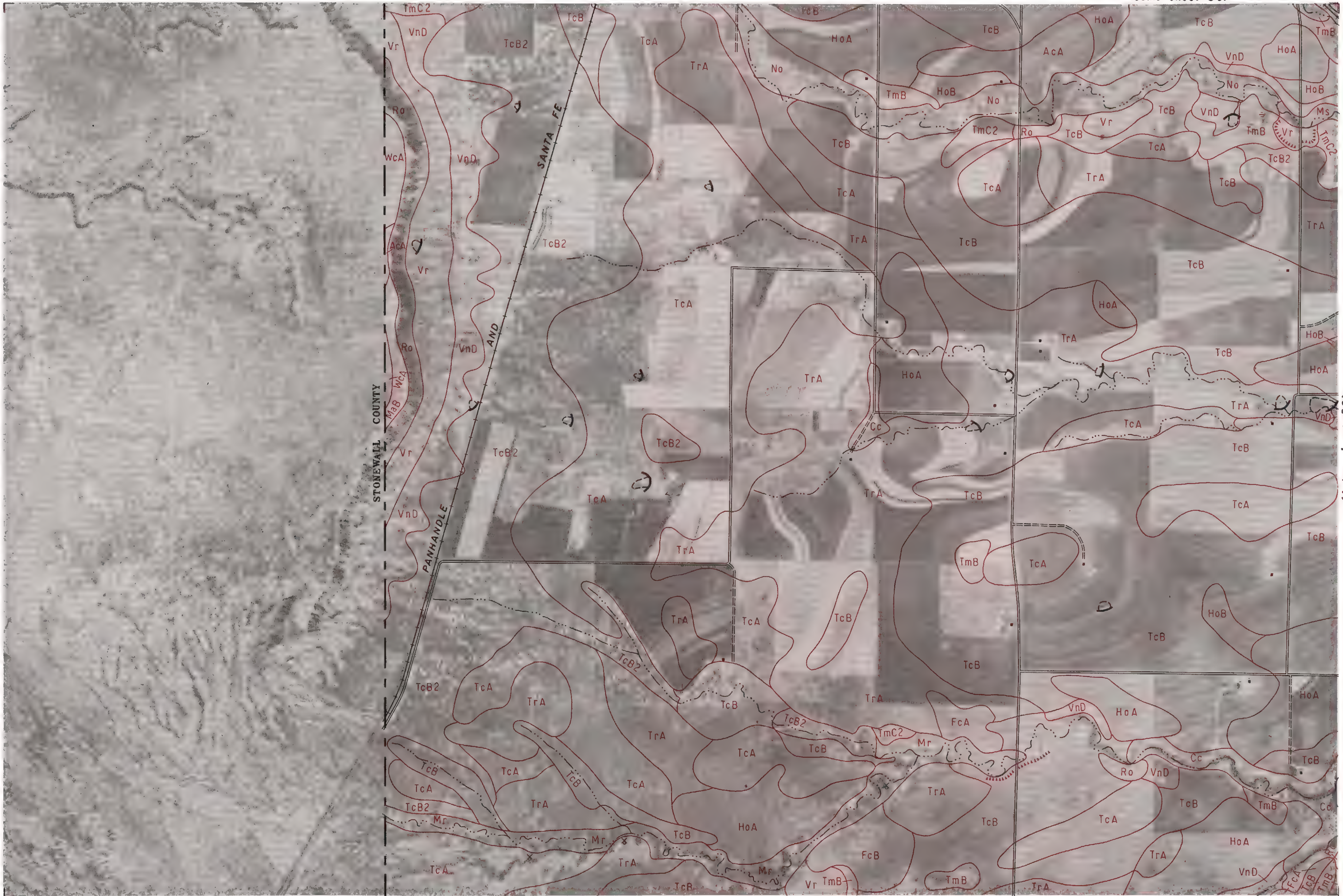
(Joins sheet 63)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 50)

57

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.



(Joins sheet 58)

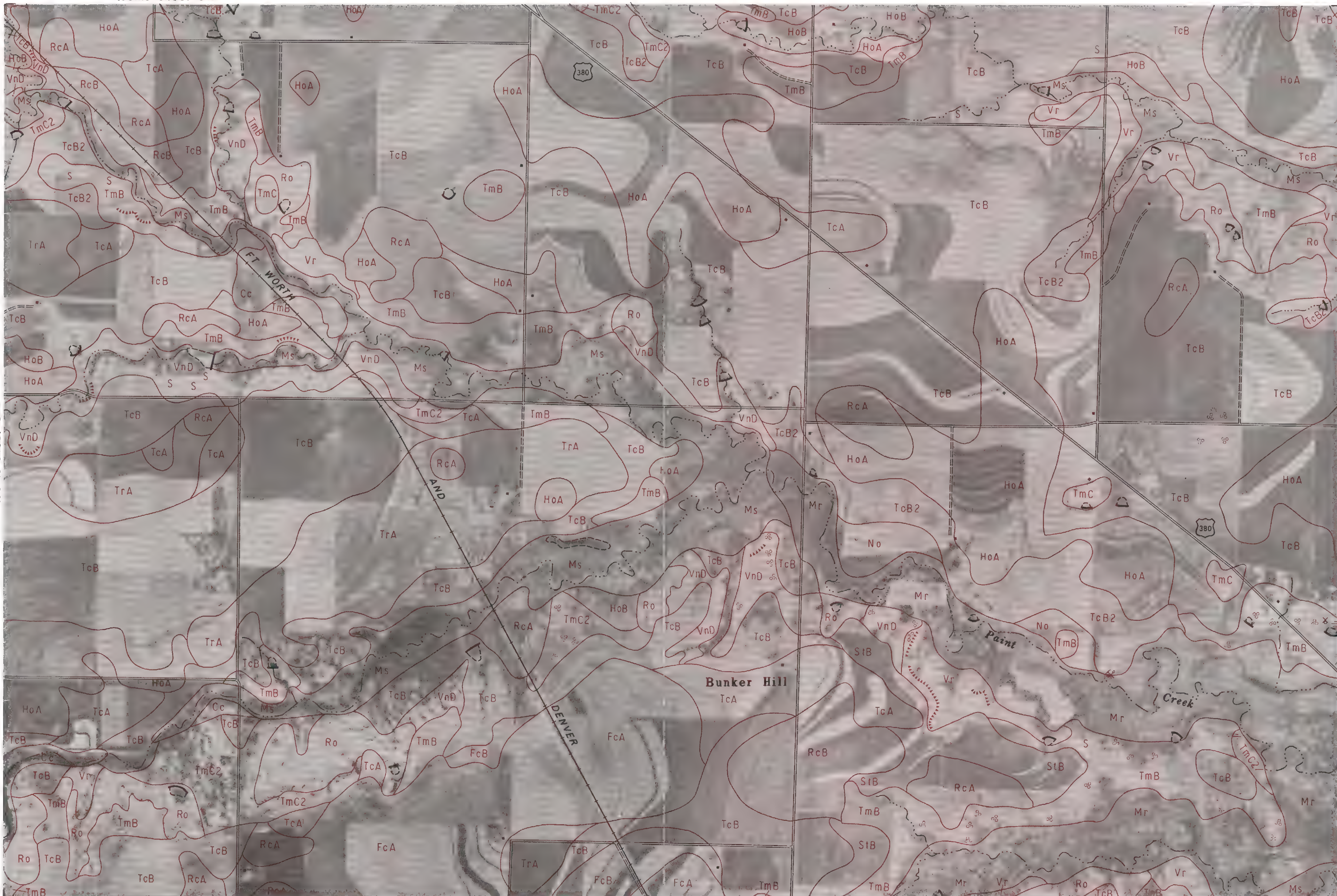
(Joins sheet 64)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

HASKELL COUNTY, TEXAS - SHEET NUMBER 58

(Joins sheet 51)

(Joins sheet 57)



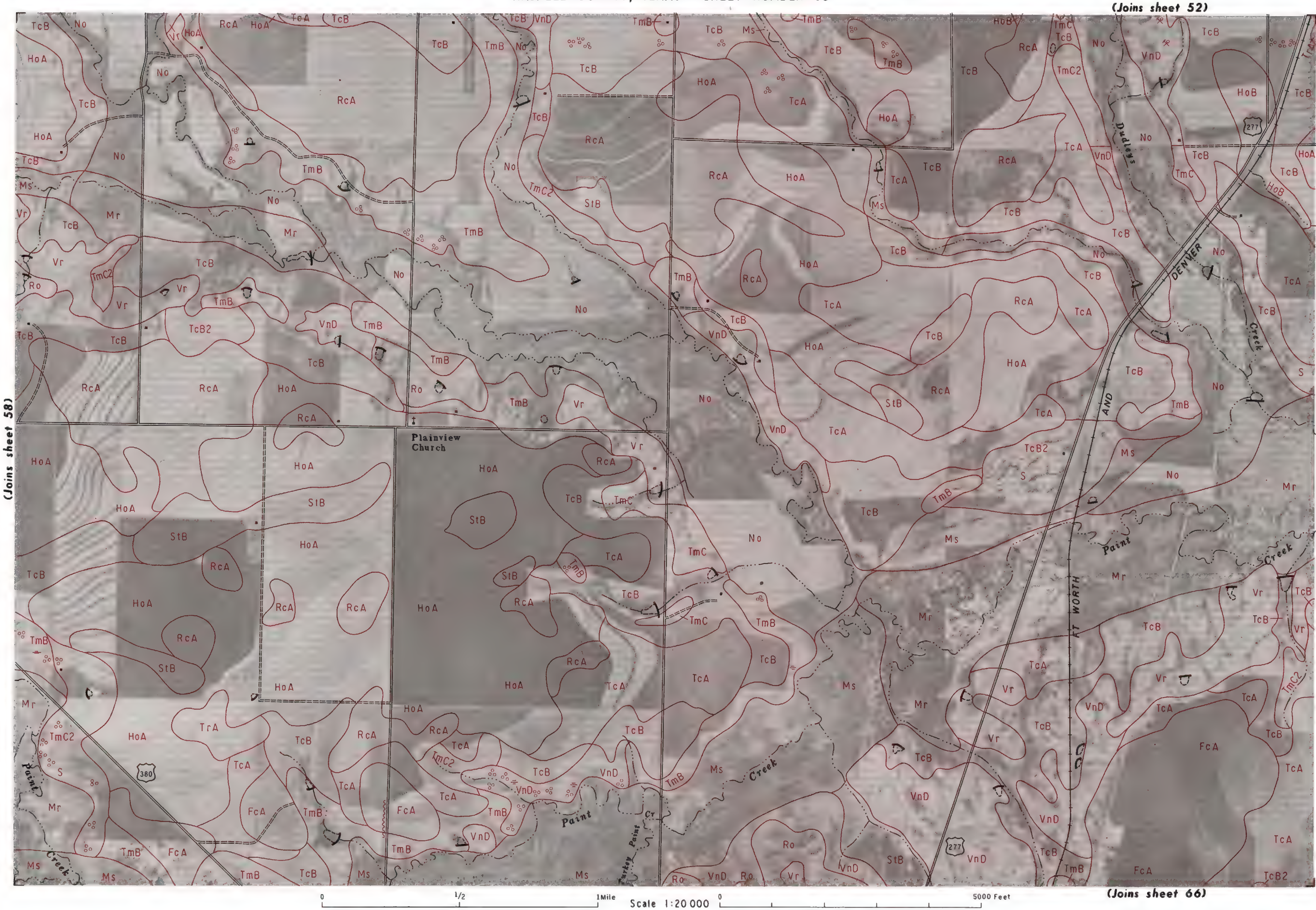
(Joins sheet 59)

(Joins sheet 65)

Scale 1:20 000

0 1/2 1 Mile

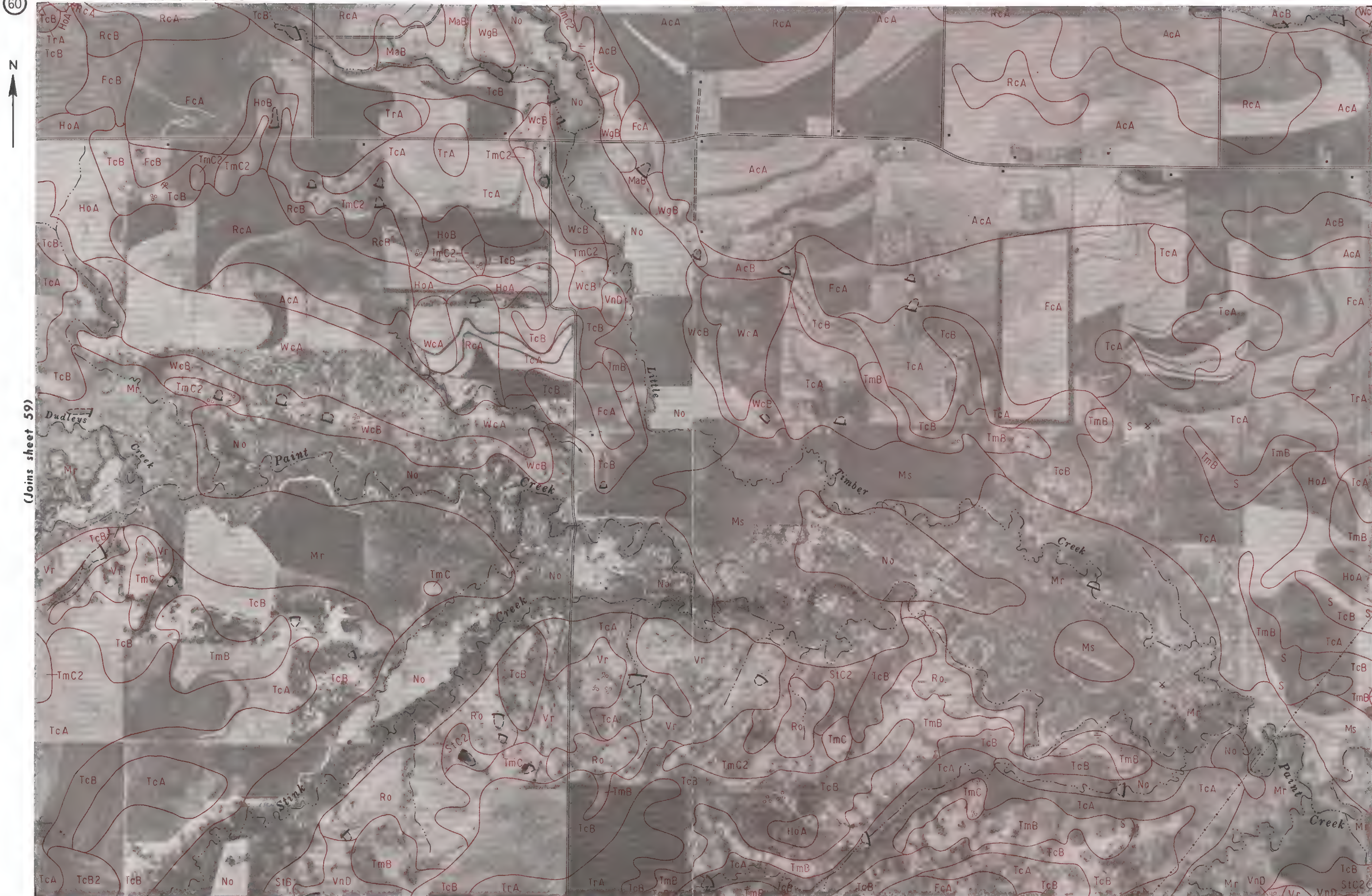
0 5000 Feet



This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

(Joins sheet 53)

(Joins sheet 59)



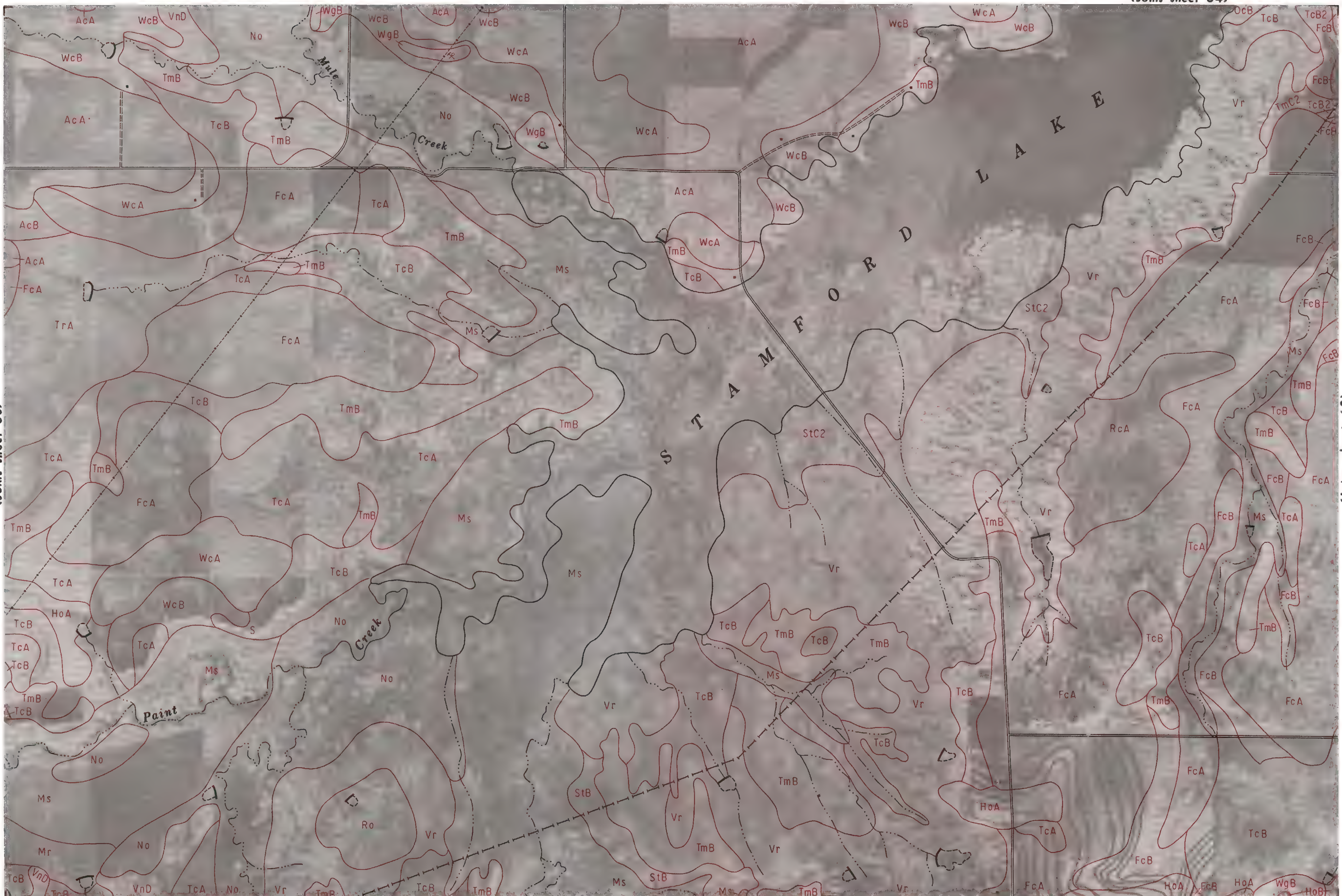
(Joins sheet 61)

(Joins sheet 67)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 54)

61



(Joins sheet 60)

(Joins sheet 62)

(Joins sheet 68)

Scale 1:20 000

0 ½ 1 Mile

0 5000 Feet

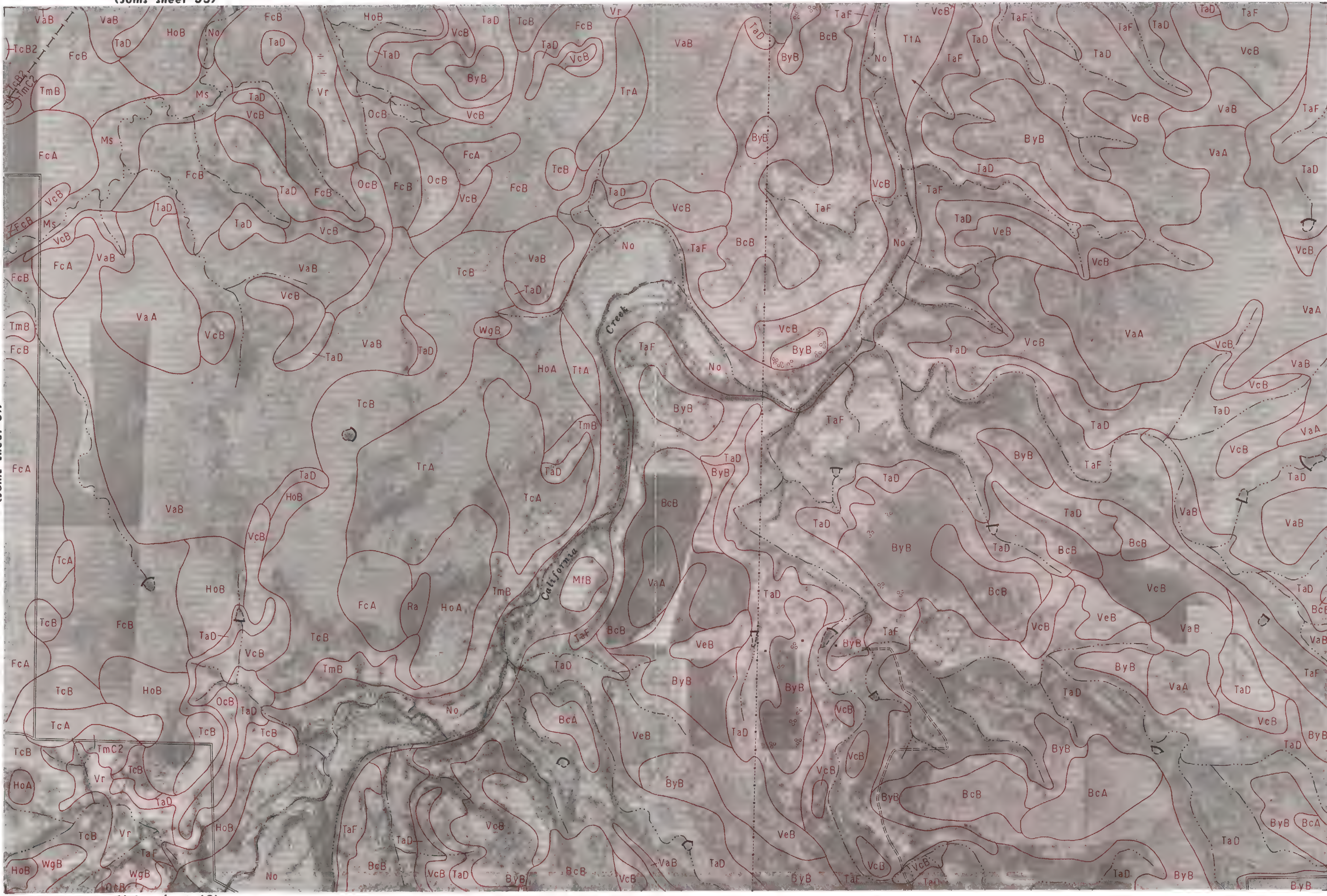
This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

62

(Joins sheet 55)

N

(Joins sheet 61)



(Joins sheet 63)

(Joins sheet 69)

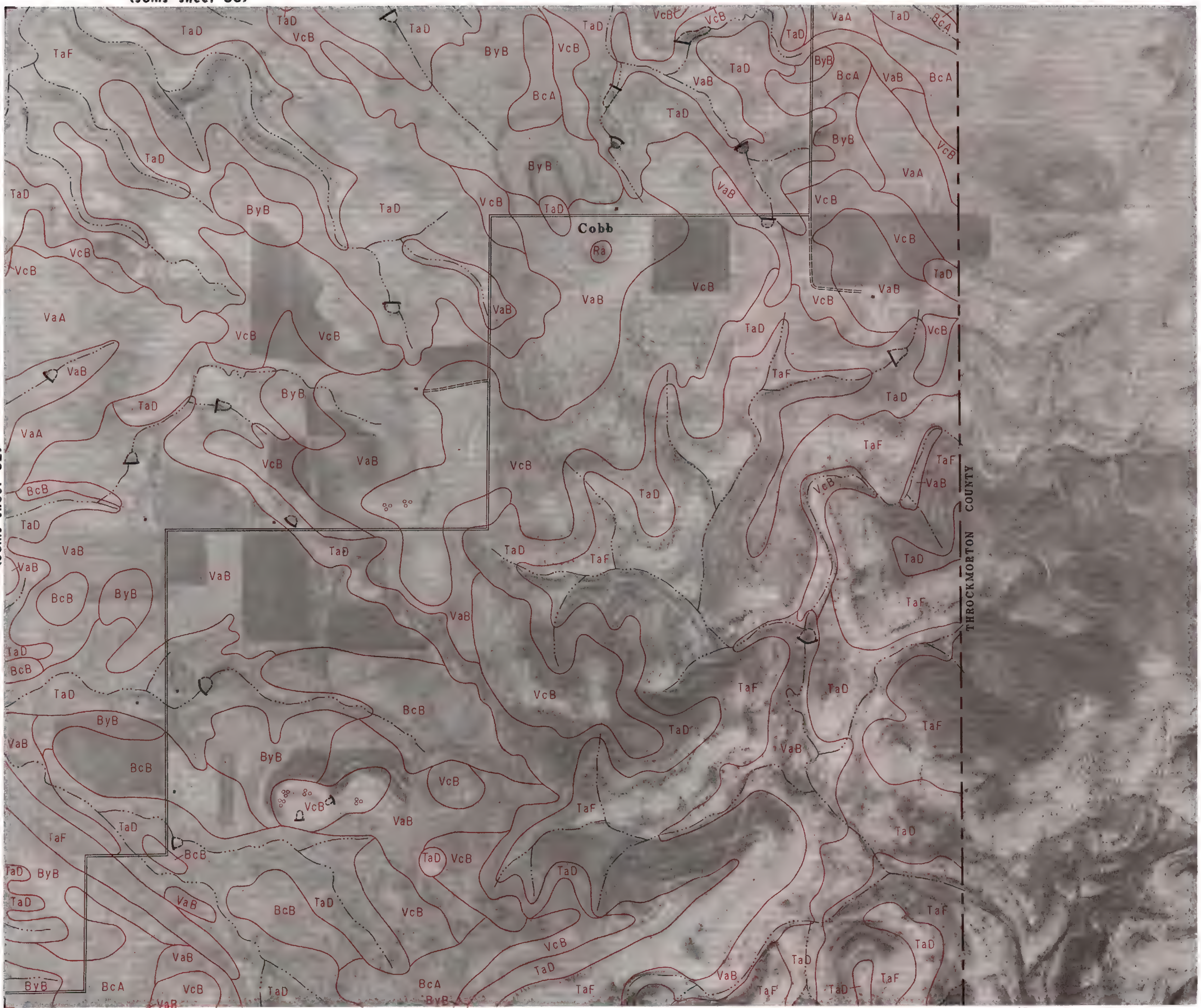
Scale 1:20 000

0 1/2 1 Mile

0 5000 Feet

(Joins sheet 56)

(Joins sheet 62)



(Joins sheet 70)

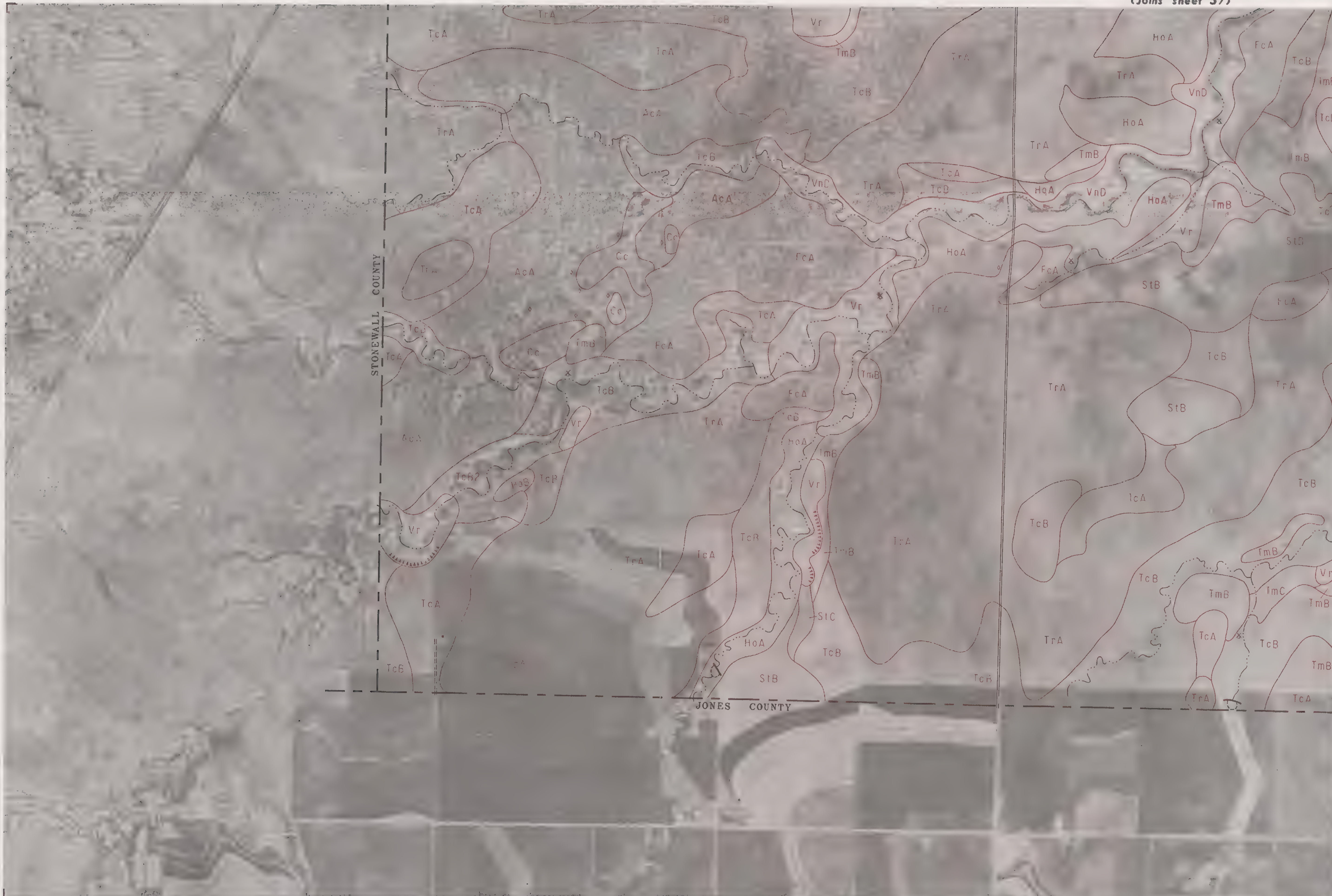
0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

N

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

HASKELL COUNTY, TEXAS - SHEET NUMBER 64

(Joins sheet 57)



Scale 1:20 000

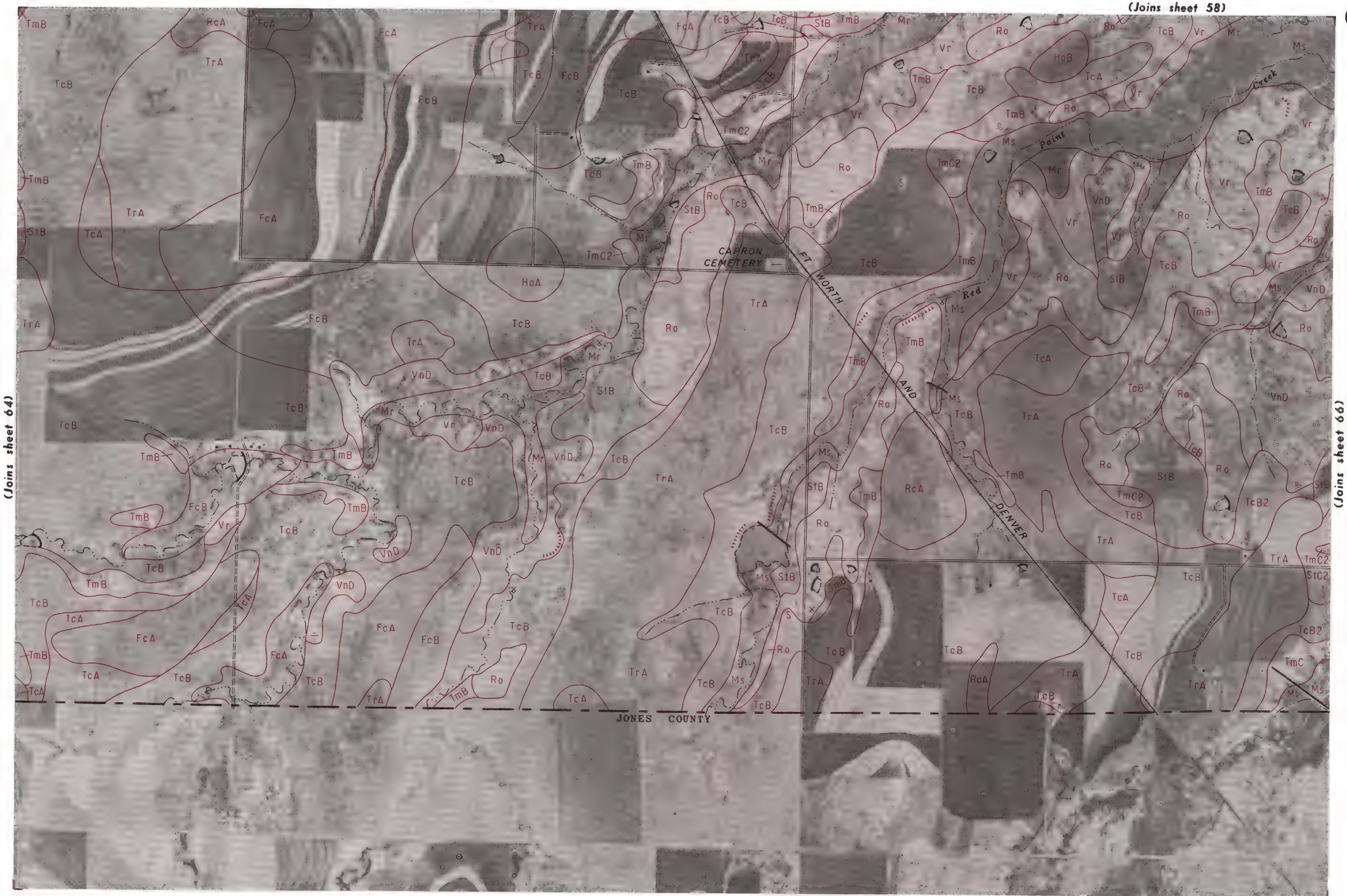
0 1/2 1 Mile

0 5000 Feet

(Joins sheet 58)

(Joins sheet 64)

(Joins sheet 66)



0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

HASKELL COUNTY, TEXAS - SHEET NUMBER 66

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(Joins sheet 59)

(Joins sheet 65)

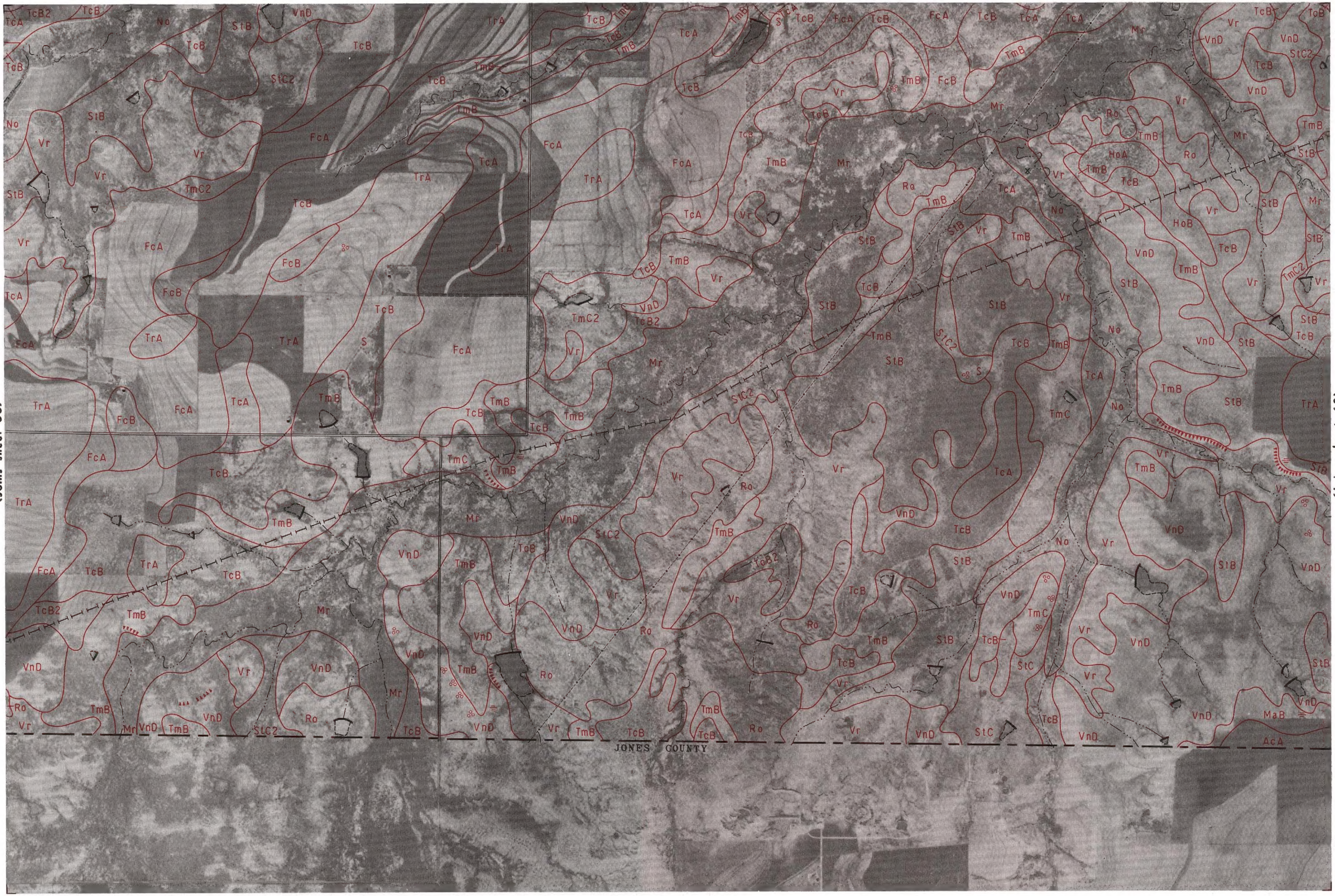
(Joins sheet 67)

0 1/2 1 Mile Scale 1:20000 0 5000 Feet

HASKELL COUNTY, TEXAS - SHEET NUMBER 67

(Joins sheet 60)

(Joins sheet 66)



(Joins sheet 68)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

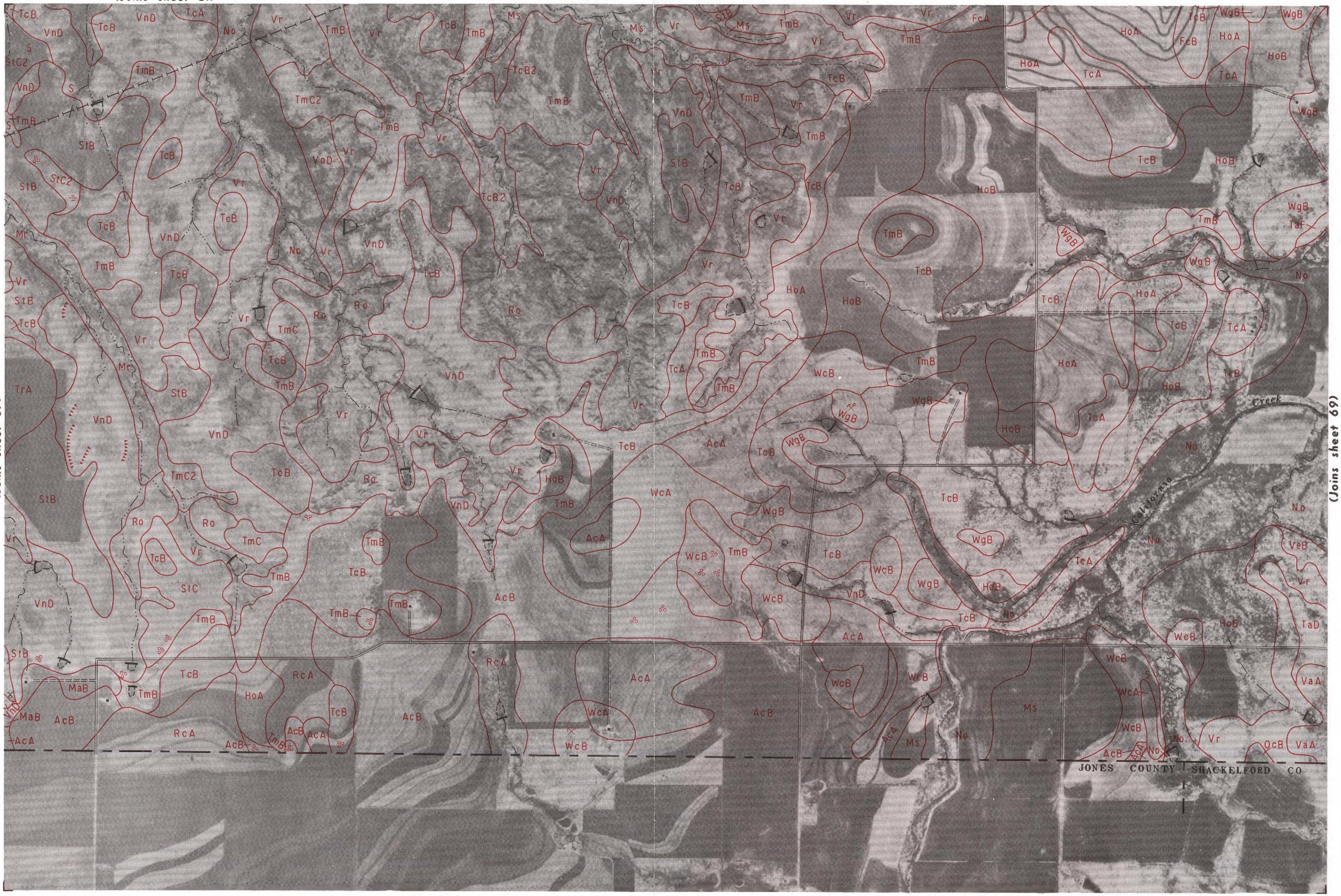
68

HASKELL COUNTY, TEXAS - SHEET NUMBER 68

(Joins sheet 61)

N

(Joins sheet 67)



(Joins sheet 69)

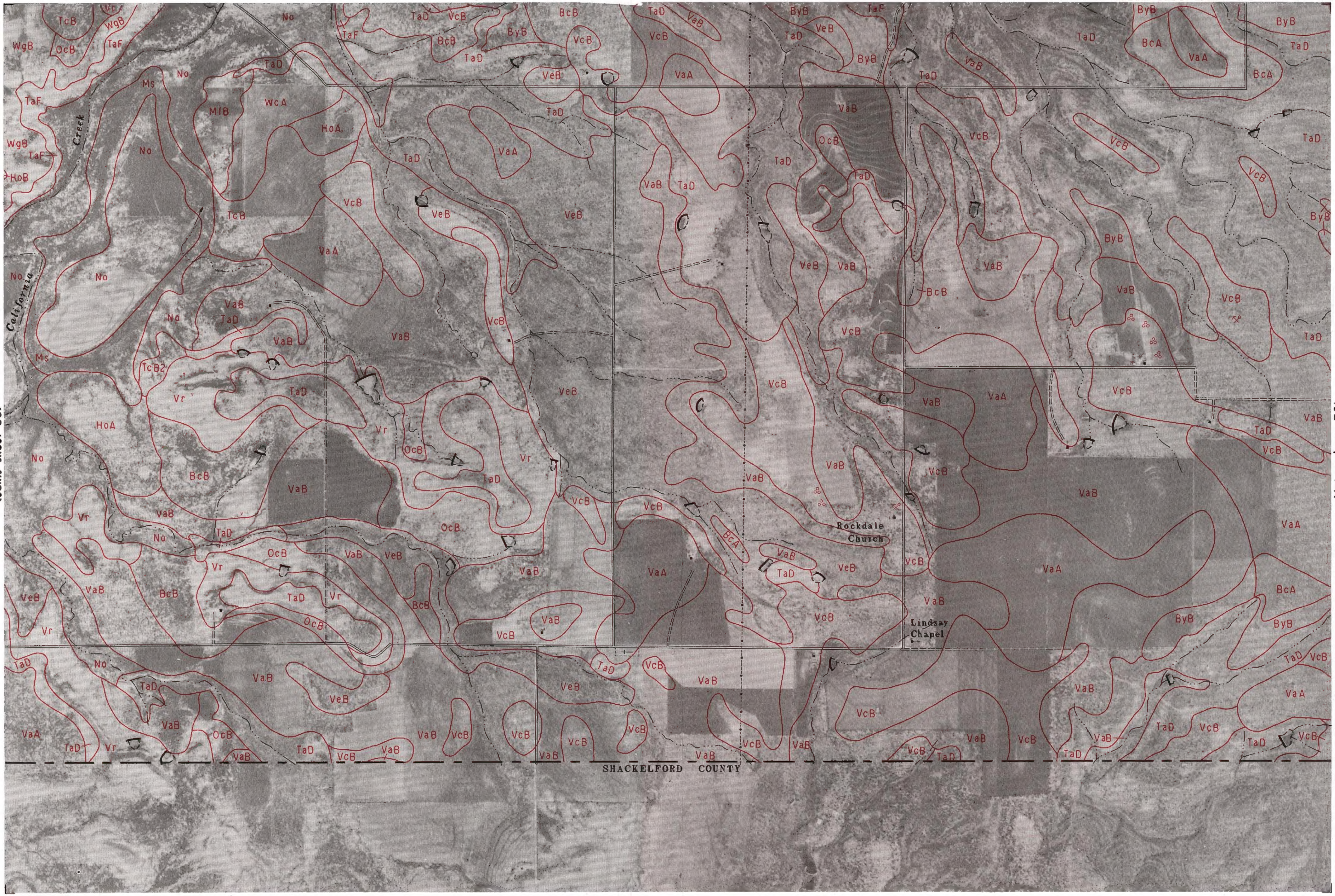
0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 62)

69

This is one of a set of maps prepared by the Soil Conservation Service, U. S. Department of Agriculture, for a soil survey report of this area. For information regarding the complete soil survey report, write the Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C. This map compiled from aerial photographs flown in 1956.

(Joins sheet 68)



(Joins sheet 70)

0 1/2 1 Mile Scale 1:20 000 0 5000 Feet

HASKELL COUNTY, TEXAS - SHEET NUMBER 70